higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

BOU- EN STRUKTUURKONSTRUKSIE N5

03 AUGUSTUS 2021

Hierdie nasienriglyn bestaan uit 9 bladsye.

Kopiereg voorbehou

VRAAG 1

1.1 **Diameter van die boute**

Krag = 96 kN Skuifspanning = 104 MPa

$\text{Spanning} = \frac{Las}{Area}$

$\text{Krag} = \text{area x spanning x n x 2}$ ✓ (Dubbelskuif)

$96 \text{ x } 10^3 = \frac{\pi d^2}{4} \text{ x } 104 \text{ x } 3 \text{ x } 2$

$96 \text{ x } 10^3 \text{ x } 4 = \pi \text{ x } d^2 \text{ x } 3 \text{ x } 2$

$$d = \sqrt{\frac{96\ x\ 10^3\ x\ 4}{104\ x\ \pi\ x\ 3\ x\ 2}}$$ ✓

$d = 13{,}99 \text{ mm}$ ✓

Gebruik = 6M16 boute ✓ (4)

1.2 **Maksimum las**

Draspanning = 248 MPa Bindstawe = 125 x 8 mm

Verbindingsplate = 6 mm dik en M16 boute

$\text{Spanning} = \frac{Las}{Area}$

$\text{Krag} = \text{area x spanning x } \eta$

$\text{Krag} = (\text{d x t}) \text{ x spanning x } \eta$ ✓

$= (16 \text{ x } 6{+}6) \text{ x } 248 \text{ x } 3$ ✓

$\text{Krag} = 142{,}848 \text{ kN}$ ✓ (3)

1.3 **Skeurspanning**

Krag = 295 kN Bindstawe = 130 × 8 mm M12 boute

$\text{Spanning} = \frac{Las}{Area}$

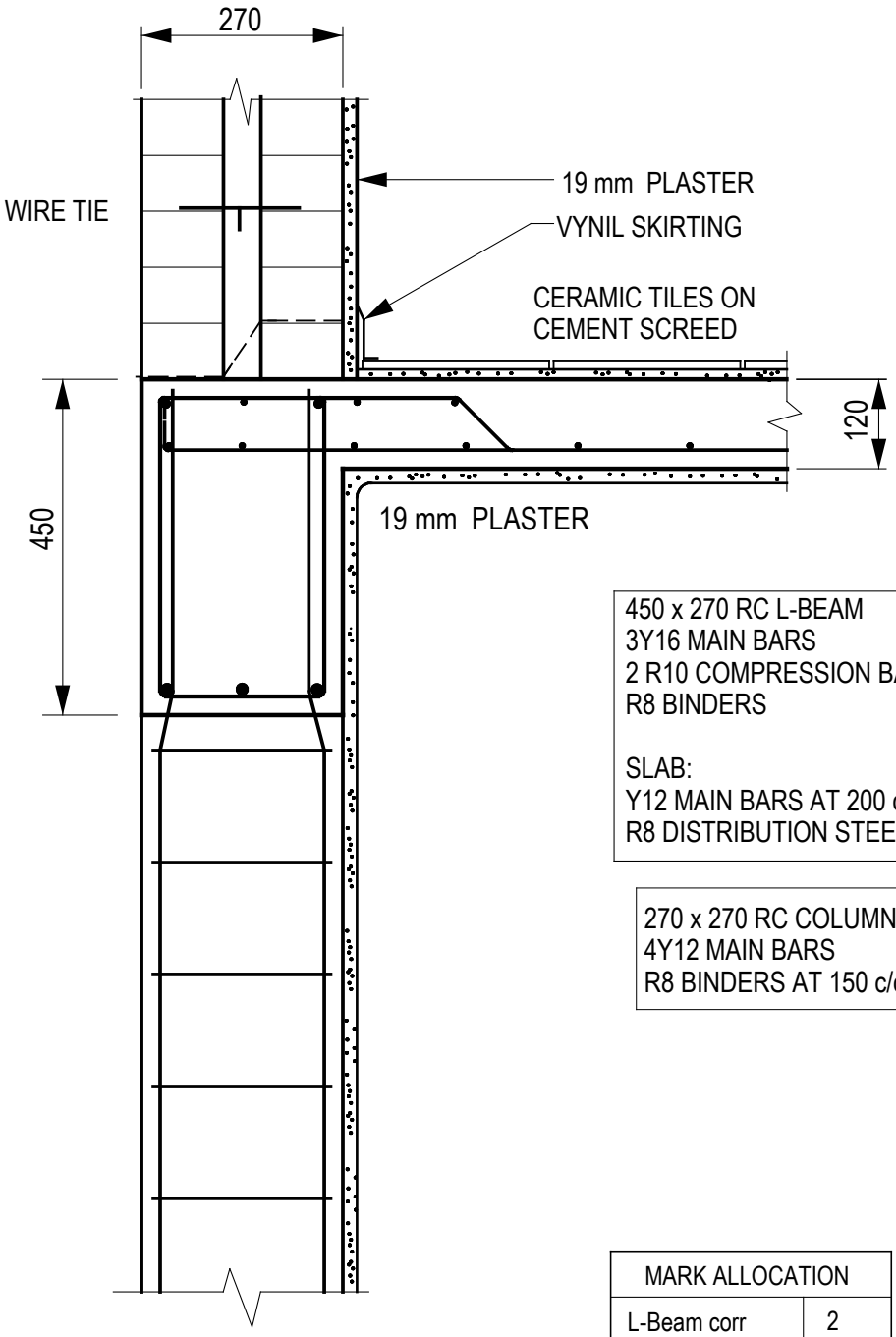
$\text{Skeurspanning} = \frac{Load}{(B\ x\ T) - \eta\ (d\ x\ t)}$ ✓

$\text{Skeurspanning} = \frac{295\ x\ 10^3}{(130\ x\ 8) - 3\ (14\ x\ 8)}$ ✓

$\text{Skeurspanning} = 419{,}03 \text{ MPa}$ ✓ (3)

[10]

QUESTION 2



450 x 270 RC L-BEAM
3Y16 MAIN BARS
2 R10 COMPRESSION BARS
R8 BINDERS

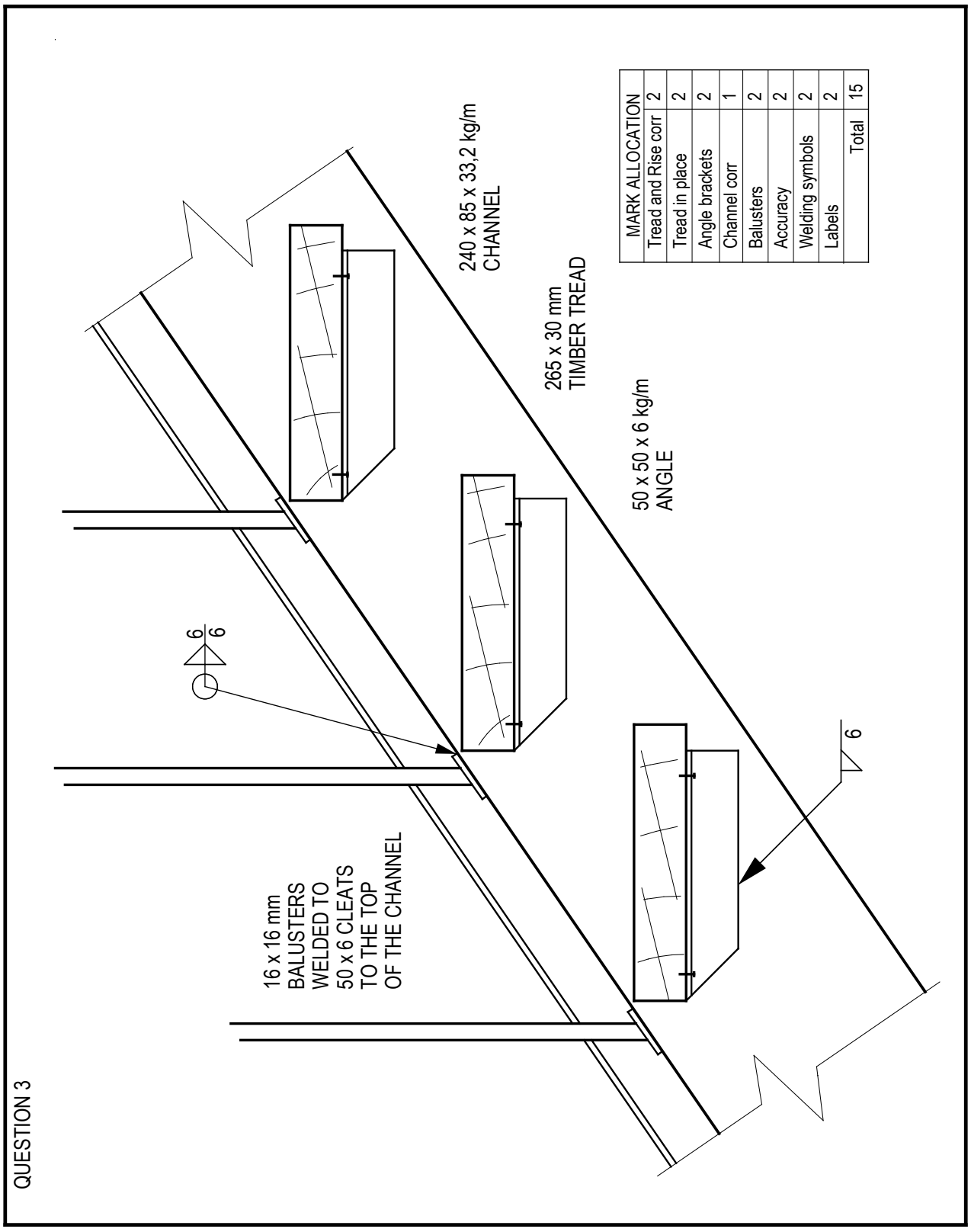
SLAB:
Y12 MAIN BARS AT 200 c/c
R8 DISTRIBUTION STEEL

270 x 270 RC COLUMN
4Y12 MAIN BARS
R8 BINDERS AT 150 c/c

MARK ALLOCATION	
L-Beam corr	2
Column	1
Brick wall	2
All reinforcement	5
Floor & details	4
Accuray	3
Labels	2
Dimensions	1
	20

Kopiereg voorbehou

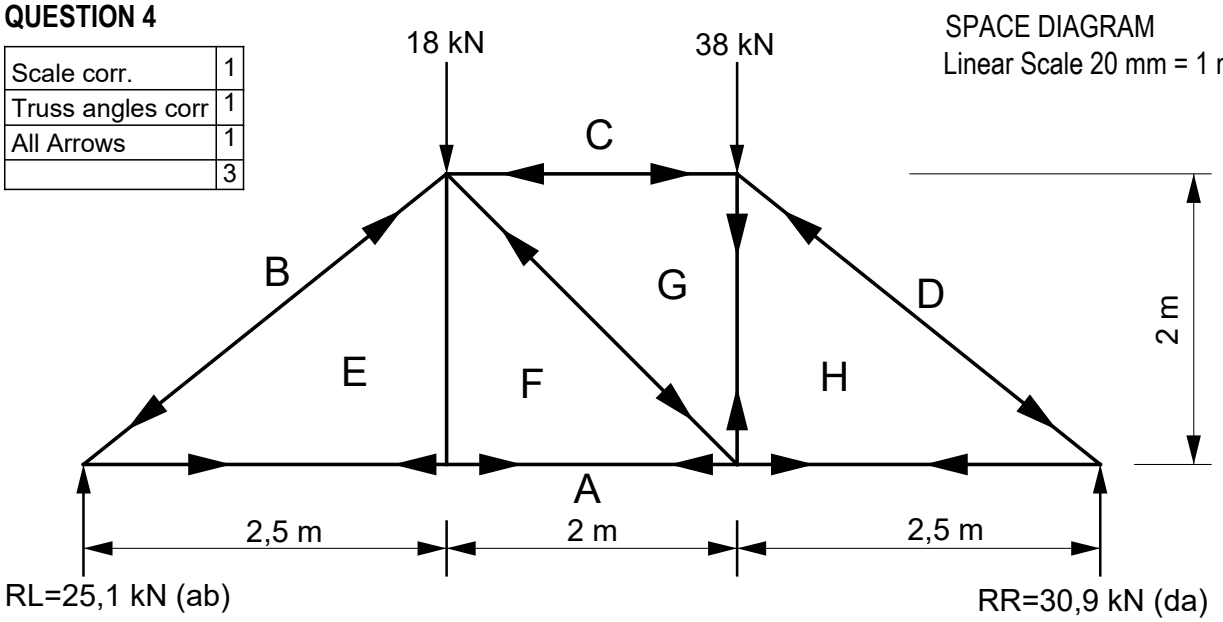
VRAAG 3


QUESTION 3
240 x 85 x 33,2 kg/m
CHANNEL
265 x 30 mm
TIMBER TREAD
50 x 50 x 6 kg/m
ANGLE
16 x 16 mm
BALUSTERS
WELDED TO
50 x 6 CLEATS
TO THE TOP
OF THE CHANNEL
6
6
6
MARK ALLOCATION
Tread and Rise corr 2
Tread in place 2
Angle brackets 2
Channel corr 1
Balusters 2
Accuracy 2
Welding symbols 2
Labels 2
Total 15

QUESTION 4

Scale corr.	1
Truss angles corr	1
All Arrows	1
	3

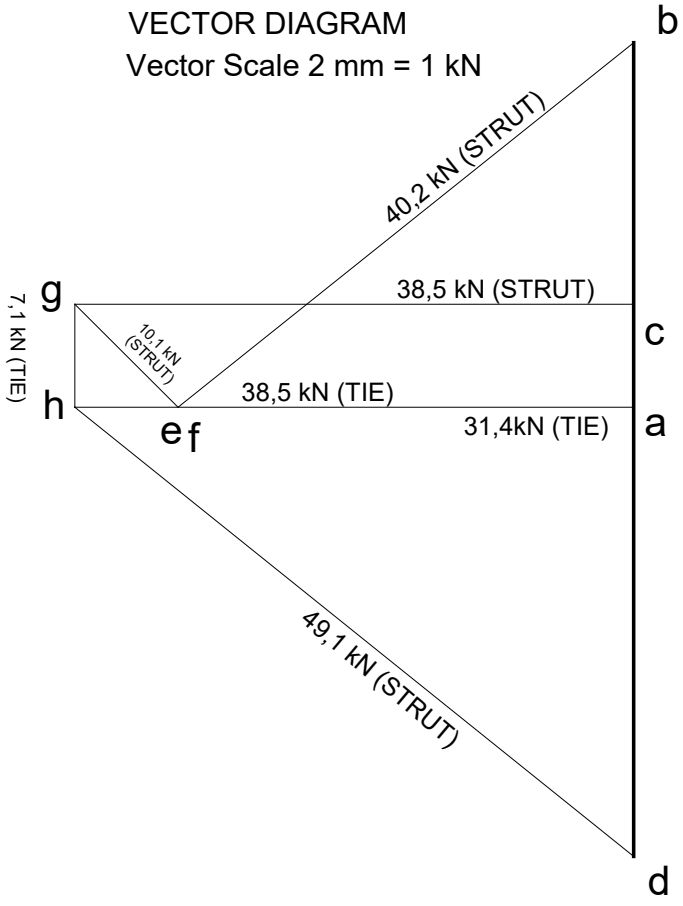
SPACE DIAGRAM
Linear Scale 20 mm = 1 m



Calculate Reactions
RR x 7 = (38 x 4,5) + (18 x 2,5)
RR = 216 / 7
RR = 30,9 kN (1 mark)

RL x 7 = (18 x 4,5) + (38 x 2,5)
RL = 176 / 7
RL = 25,1 kN (1 mark)

VECTOR DIAGRAM
Vector Scale 2 mm = 1 kN



MEMBER	MAGNITUDE	TYPE
AE	31,4 kN	Tie
AF	31,4 kN	Tie
AH	38,5 kN	Tie
BE	40,2 kN	Strut
CG	38,5 kN	Strut
DH	49,1 kN	Strut
EF	00,00	Redundant
FG	10,1 kN	Strut
GH	7,1 kN	Tie

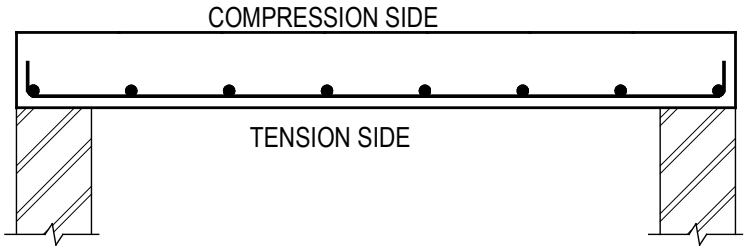
(15 marks)

18 answers corr = 15 marks; 14 corr = 10 marks; 10 corr = 8 marks; 8 corr = 6 marks; 6 corr = 4 marks; 4 corr = 2 marks; 2 corr = 1 mark

[Total = 20]

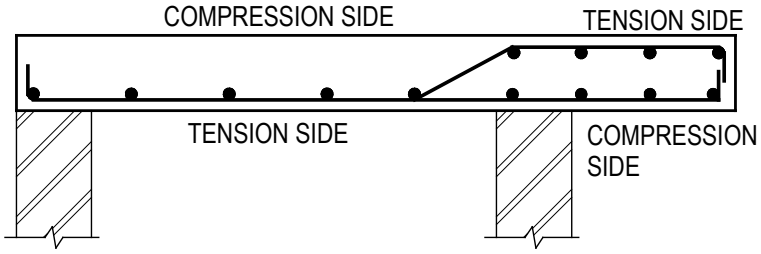
VRAAG 5

QUESTION 5



SLAB A

MARK ALLOCATION (SLAB A)	
Tension steel corr	1
Distribution steel corr	1
Tension & compression indicated	2
Total	4



SLAB B

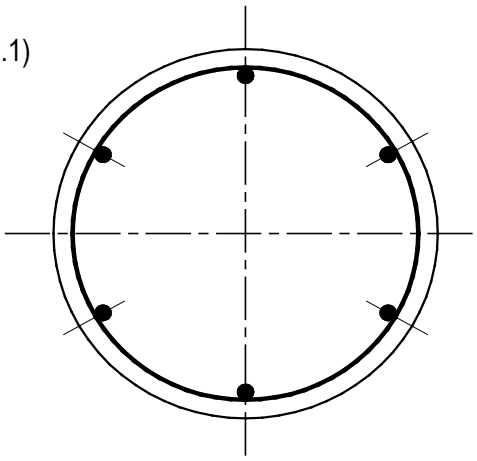
MARK ALLOCATION (SLAB A)	
Tension steel corr	2
Distribution steel corr	2
Tension & compression indicated	2
Total	6

[Totaal = 10]

VRAAG 6

QUESTION 6

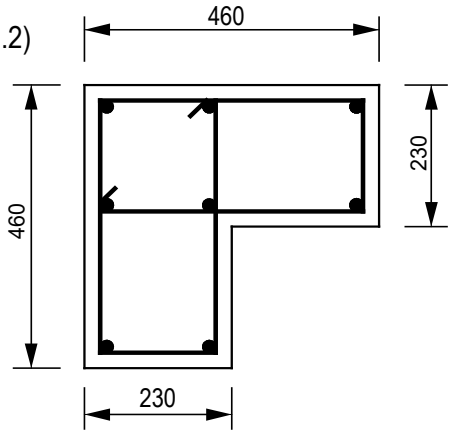
(6.1)



CIRCULAR COLUMN
Ø600 with 6Y25 main bars
and R10 helical binder

MARK ALLOCATION (6.1)	
Diameter corr.	1
Steel bars spacing corr	1
Binder in place	1
Centre lines	1
Title	1
Total	5

(6.2)



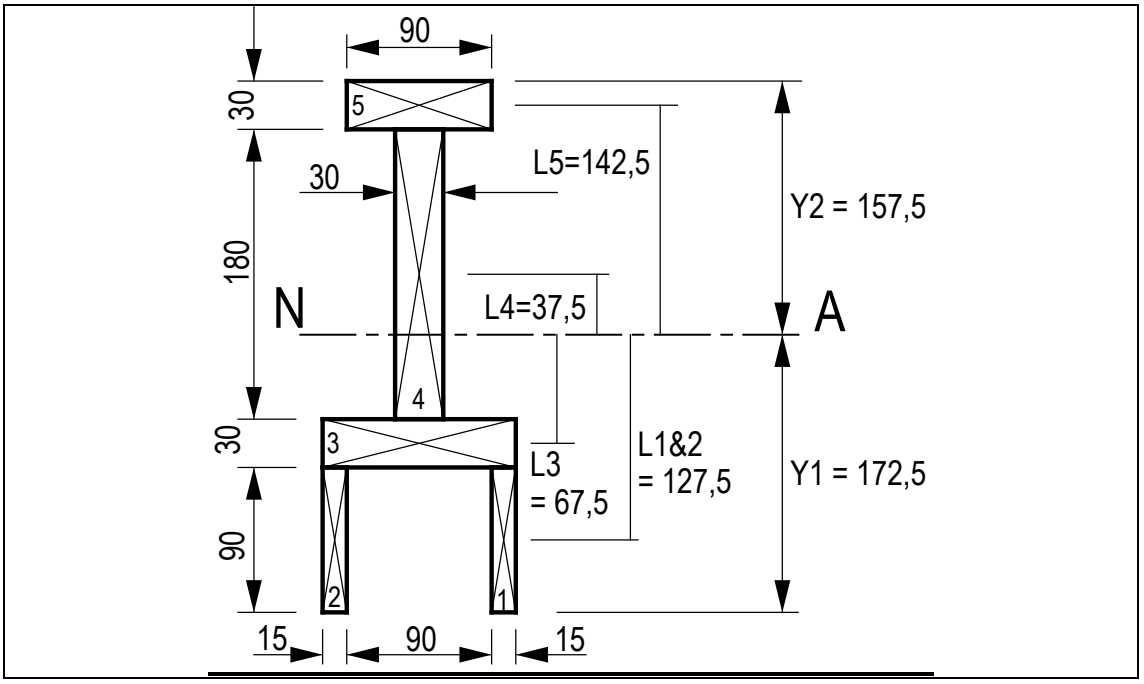
L-SHAPED COLUMN
460 x 230 with 8Y20 main bars
and Y10 Stirrups at 150 c/c

MARK ALLOCATION (6.2)	
Size & Shape corr.	2
Steel bars spacing corr	1
Binder in place	1
Title	1
Total	5

[Totaal = 10]

VRAAG 7

7.1



Ontbrekende afmetings:

Y_2: 330 – 172,5 = 157,5 ✓

$L_{1\&2}$: $172,5 - (30/2 + 90) = 127,5$ ✓

L_3: $172,5 - (90 + 30/2) = 67,5$ ✓

L_4: $(90 + 30 + 180/2) - 172,5 = 37,5$ OR

L_4: $157,5 - (30 + 180/2) = 37,5$ ✓

L_5: $157,5 - (30/2 + 180) = 37,5$

(4)

7.2 **Bereken die tweede areamoment**

$I_{xx\ Totaal} = 2\left(\frac{bd^3}{12} + AL^2\right) + \left(\frac{bd^3}{12} + AL^2\right) + \left(\frac{b\,d^3}{12} + AL^2\right) + \left(\frac{b\,d^3}{12} + AL^2\right)$

$I_{xx\ 1\&2} = 2\left(\frac{15\,x\,90^3}{12} + 15\,x\,90\,x\,127{,}5^2\right)$

$= 2\,(911\,250 + 21\,945\,937{,}5) = 45\,714\,375\ mm^4$ ✓✓

$I_{xx\ 3} = \left(\frac{120\,x\,30^3}{12} + 120\,x\,30\,x\,67{,}5^2\right)$

$= (270\,000 + 16\,402\,500) = 16\,672\,500\ mm^4$ ✓✓

$I_{xx\ 4} = \left(\frac{30\,x\,180^3}{12} + 30\,x\,180\,x\,37{,}5^2\right)$

$= (14\,580\,000 + 7\,593\,750) = 22\,173\,750\ mm^4$ ✓✓

$I_{xx\ 5} = \left(\frac{90\,x\,30^3}{12} + 90\,x\,30\,x\,37{,}5^2\right)$

$= (202\,500 + 3\,796\,875) = 3\,999\,375\ mm^4$ ✓✓

I_{xx} TOTAAL = 88 560 000 mm⁴ ✓ (9)

7.3 **Profielmodulus (Z) om die x-x axis**

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

$Z = \frac{88\,560\,000\ mm4}{172{,}5\ mm}$ ✓

$Z = 513\,391{,}3\ mm^3$ ✓ $Z = 513{,}4 \times 10^{-6}\ m^3$ (2)

[15]

TOTAAL: 100

Kopiereg voorbehou