

**GAUTENG DEPARTMENT OF EDUCATION  
GAUTENGSE DEPARTEMENT VAN ONDERWYS  
SENIOR CERTIFICATE EXAMINATION  
SENIORSERTIFIKAAT-EKSAMEN**

**TECHNIKA (CIVIL / SIVIEL) HG**

**QUESTION 1 / VRAAG 1**

- 1.1
- 1.1.1 Selection of the correct material.  
*Selektering van die regte materiaal.*
- 1.1.2 Measuring materials into suitable proportions.  
*Uitmeet van die materiaal in geskikte verhoudings.*
- 1.1.3 Mixing them together by hand or machine.  
*Vermenging daarvan per hand of masjien.*
- 1.1.4 Transporting and placing the mixture.  
*Vervoer en giet van die mengsel.*
- 1.1.5 Compaction of the concrete.  
*Kompaktering van die beton.*
- 1.1.6 Prevention of drying-out while setting.  
*Voorkoming van uitdroging terwyl dit set.*
- 1.1.7 Reinforcing of the concrete to withstand the compressive and tensile stress.  
*Bewapening van die beton om druk- en trekspanning te weerstaan.* 5x2=(10)
- 1.2
- 1.2.1 It must be strong enough to support the weight of the wet concrete.  
*Dit moet sterk genoeg wees om die massa van die nat beton te dra.*
- 1.2.2 It should not bend or deflect under the weight of the wet concrete.  
*Dit moet nie buig of meegee onder die las van die nat beton nie.*
- 1.2.3 It must be erected accurately according to the measurement sizes and positioned as the wet concrete takes the shape of the formwork.  
*Dit moet akkuraat volgens maat, grootte en posisie aanmekaar getimmer word, aangesien die nat beton die vorm van die bekisting aanneem.*
- 1.2.4 The joints must be leakproof to prevent the grout from escaping.  
*Die lasplekke moet lekvry wees sodat die voegbry nie uitloop nie.*

1.2.5 The formwork must be of a size to be easily erected by hand or by hoist.  
*Die grootte van die bekisting moet so wees dat dit maklik met die hand of met meganiese hystoerusting in posisie geplaas kan word.*

1.2.6 The material used in the making of the formwork must be of such a nature that it can be reused.  
*Die materiaal waarvan die bekisting vervaardig is, moet van so 'n aard wees dat dit hergebruik kan word.*

1x5=(5)

1.3

1.3.1 To cope with the tensile strength in the concrete.  
*Om die trekspanning in beton te dra.*

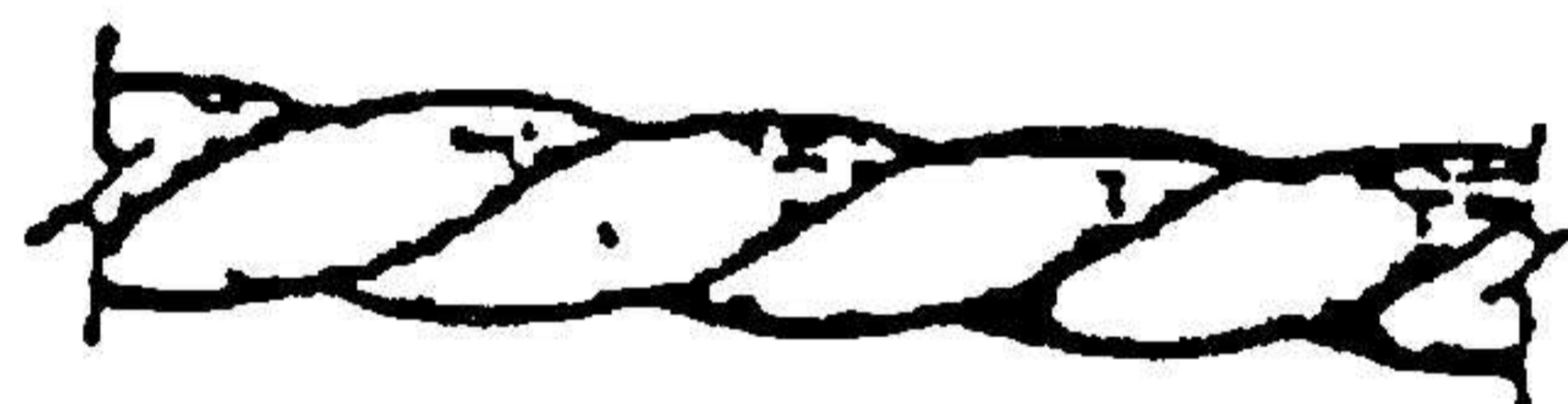
1.3.2 To eliminate the shear force which occurs at the supports.  
*Om die skuifspanning wat by die steunpunte voorkom, te elimineer.*

1.3.3 To increase the compressive strength of the concrete  
*Om die drukspanning wat beton kan weerstaan, te verhoog.*

1.3.4 To limit cracks which occur during the curing period.  
*Om barste wat as gevolg van krimpings voorkom, te beperk.*

1x4=(4)

1.4



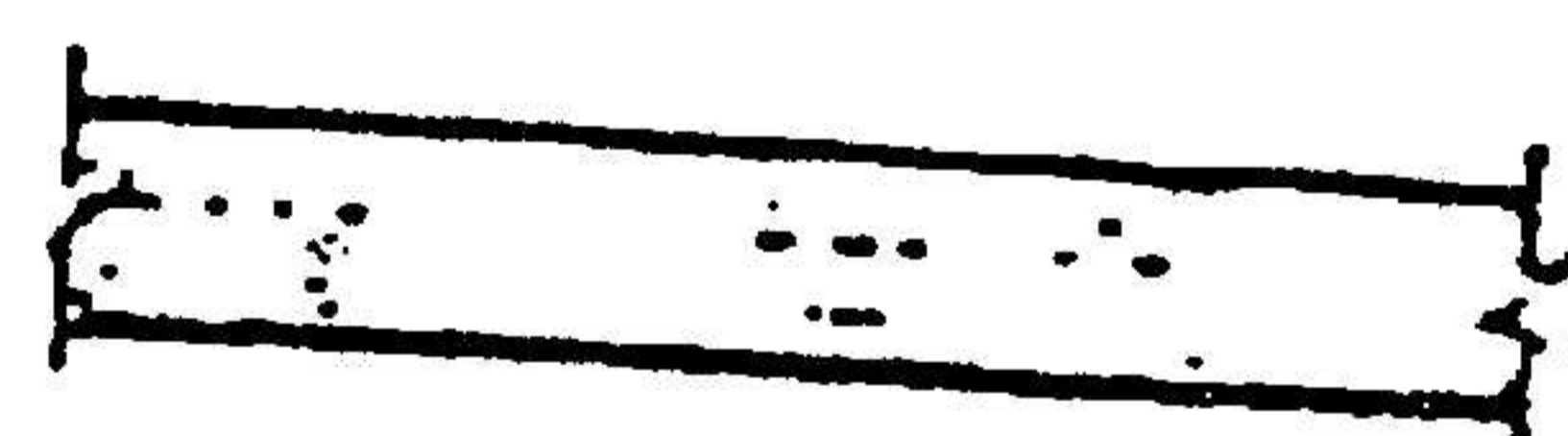
Square twisted bar  
*Vierkantige gedraaide staaf*



Twisted ribbed bar  
*Gedraaide geribde staaf*



Ribbed bar  
*Geribde staaf*



Plain round bar  
*Gewone ronde staaf*

1x4=(4)

1.5

1.5.1 Goods should be stacked on strong, sound floors.  
*Goedere moet op sterk, stewige vloere gestapel word.*

1.5.2 No stack should be higher than three times its width.  
*Geen stapel mag hoër as drie maal sy breedte wees nie.*

1.5.3 Stacks should be bonded or interlocked.  
*Stapels moet gebind of in mekaar gesluit word.*

1.5.4 Choose the site for stacking with care and avoid projections.  
*Kies die bergplek met oorleg en verhoed dat materiaal uitsteek.*

- 1.5.5 No stack should obstruct fire-fighting equipment, light or ventilation.  
*Stapels moet nie brandbestrydingstoerusting, lig of ventilasie versper nie.*
- 1.5.6 Stacks should not obstruct aisles or exits.  
*Stapels mag nie gange of uitgange versper nie.*
- 1.5.7 Flammable material and liquids should be kept in flame-proof containers and stored safely.  
*Vlambare materiaal en vloeistowwe moet in spesiale vlamdigte houers in veilige bewaring geberg word.*
- 1.5.8 Gases and acids should be kept in special containers and stored in a safe place.  
*Gasse en sure moet in spesiale houers in veilige plekke geberg word.*

**ANY FIVE TWO MARKS EACH:**  
**ENIGE VYF TWEE PUNTE ELK:** 5x2=(10)

- 1.6
- 1.6.1 Appearance  
*Voorkoms*
- 1.6.2 Density  
*Digtheid*
- 1.6.3 Melting point  
*Smeltpunt*
- 1.6.4 Visible light transmission  
*Sigbare lig transmissie*
- 1.6.5 Solar heat transmission  
*Son-hitte transmissie*
- 1.6.6 Ultra-violet ray transmission  
*Ultravioletstrale transmissie*
- 1.6.7 Durability  
*Duursaamheid*
- 1.6.8 Strength  
*Sterkte*
- 1.6.9 Thermal properties  
*Termiese hoedanighede*
- 1.6.10 Sound isolation  
*Klankisolasië*
- 1.6.11 Behaviour in fire  
*Gedrag in vuur*

(Any 5 / Enige) 5x1=(5)

## 1.7

1.7.1 4 kN per square meter  
4 kN per vierkante meter (1)

1.7.2 2 kN per square meter  
2 kN per vierkante meter (1)

## 1.8

1.8.1	Green	Groen	(1)
	Blue	Blou	(1)
	Black	Swart	(1)
	Grey	Grys	(1)
	Red	Rooi	(1)

## 1.9

1.9.1 An expert must erect scaffolds.  
*Steiers moet deur 'n kenner opgerig word.*

1.9.2 Wood for scaffolding must be planed and not painted.  
*Hout vir steiers moet skoon geskaaf en nie geverf wees nie.*

1.9.3 Scaffolding boards must be properly secured to prevent them from sliding.  
*Steierplanke moet stewig vas wees om te voorkom dat dit gly.*

1.9.4 Scaffolding boards must overlap to prevent falls.  
*Steierplanke moet oorvleuel om valle te voorkom.*

1.9.5 The surface of the scaffolding must be kept dry. Dampness can cause slippery conditions.  
*Steierplanke moet droog gehou word. Nattigheid veroorsaak gladde oppervlakte.*

1.9.6 Scaffolds must not be overloaded.  
*Steiers mag nie oorlaai word nie.*

1.9.7 There must be no loose bricks or tools lying around the working area.  
*Geen stene of los gereedskap mag op die werkruimte rondlê nie.*

1.9.8 Scaffolds must be sturdy and strong, not to sway.  
*Steiers moet stewig en sterk wees sodat dit nie wieg nie.*

1.9.9 Scaffolds must be erected as near as possible to the wall.  
*Steiers moet so naby as moontlik aan die muur opgerig word.*

1.9.10 Scaffolding must have base plates.  
*Steierplanke moet van voetplate voorsien wees. (10)*

1.10

1.10.1 Moisture content of wood

*Hoeveelheid vog in die hout*

1.10.2 Defects in the wood

*Defekte in die hout*

1.10.3 Grading of wood

*Graad van die hout*

1.10.4 Lengths available

*Lengtes waarin beskikbaar*

1.10.5 Twisting

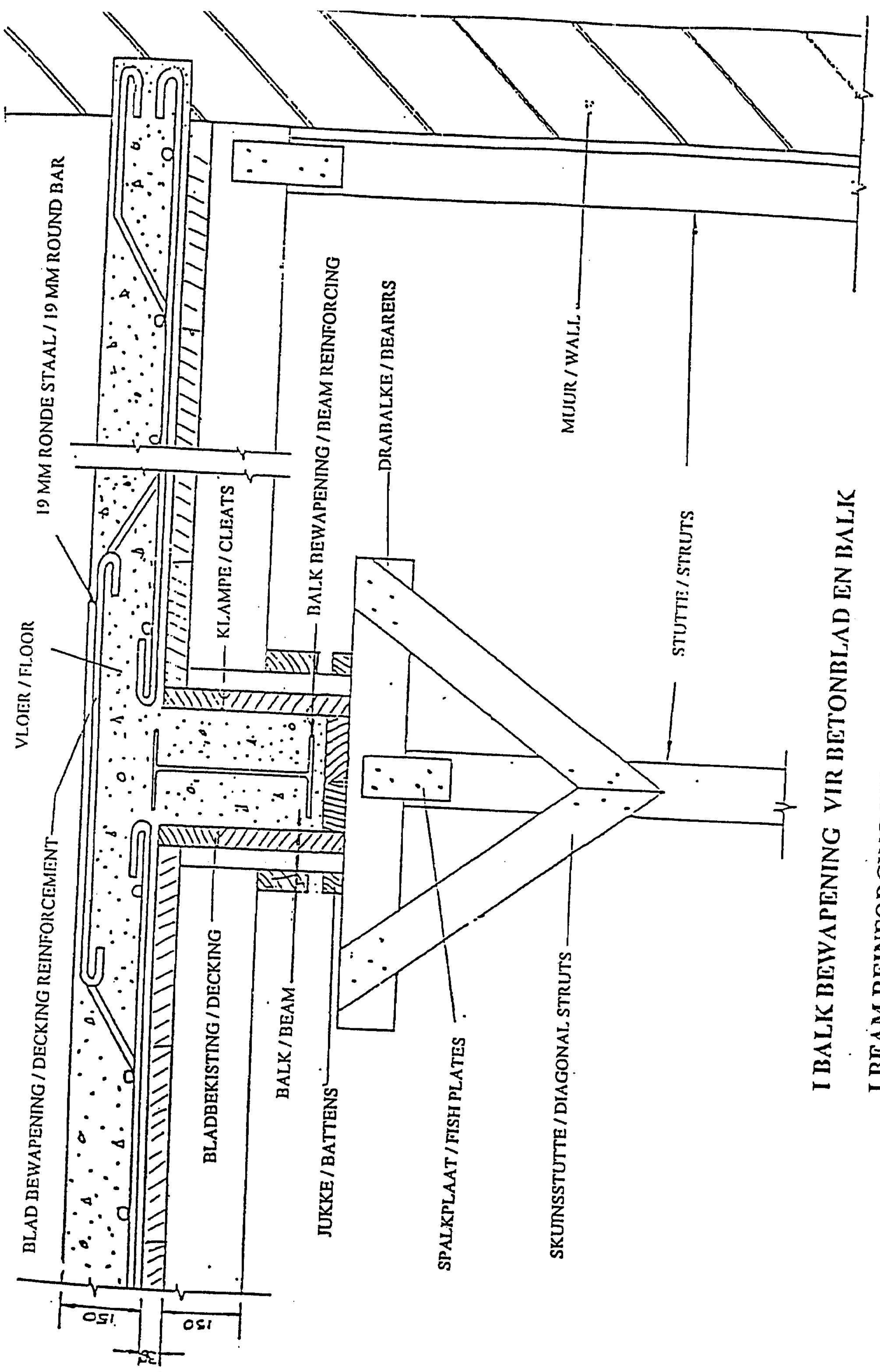
*Buigbaarheid*(5)  
[60]**QUESTION / VRAAG 2**

BEAM	2	BALK
FLOOR	2	VLOER
DECKING	4	BLADBEKISTING
BEARERS	2	DRABALKE
BATTENS	2	JUKKE
CLEATS	2	KLAMPE
FISH PLATES	2	SPALKPLAAT
DIAGONAL STRUTS	2	SKUINSSTUTTE
STRUT	4	STUTTE
BEAM REINFORCEMENT	2	BALKBEWAPENING
DECKING REINFORCEMENT	4	BLADBEWAPENING
WALL	4	MUUR
WALL INTRUDING	4	MUURINDRINGING
DIMENSIONS	4	AFMETINGS
LABELLING	4	BYSKRIFTE
LINEWORK	2	LYNWERK
NEATNESS	2	NETHEID
SCALE	2	SKAAL

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60

[60]



I BALK BEWAPENING VIR BETONBLAD EN BALK  
 I BEAM REINFORCING FOR CONCRETE SLAB AND BEAM

A	B	C	D
			<b>Substructure centre line / Onderbou hartlyn</b>
			2 x 6 000 = 12 000 mm
			2 x 7 000 = 14 000 mm
			26 000 mm
			Minus 4 x 330 = 1320 mm
			24680 mm
			The centre line is 24,68 metres / Die hartlyn is 24,68 meter.
			Height of the substructure is 450 mm.
			Hoogte van die onderbou is 450 mm.
			50 bricks per square meter for a half-brick wall
			50 stene per vierkante meter vir 'n halfsteenmuur
			There are 3 half-brick walls.
			Daar is 3 halfsteenmure.
1/	24.68 <u>0,45</u> 11,106	11,106 m	
3/	11,106 <u>50</u> 555,3	1665,9	1666 bricks are required. Daar is 1666 stene nodig.
			<b>Superstructure centre line / Bobou hartlyn</b>
			2 x 6 000 = 12 000 mm
			2 x 7 000 = 14 000 mm
			26 000 mm
			Minus 4 x 220 = 880 mm
			25120 mm
			The centre line is 25,12 metres / Die hartlyn is 25,12 meter.
			Height of the superstructure is 2800 mm.
			Hoogte van die bobou is 2800 mm.
			50 Bricks per square meter for a half-brick wall
			50 stene per vierkante meter vir 'n halfsteenmuur
			There are 2 half-brick walls
			Daar is 2 halfsteenmure

	25,12 <u>2,8</u> 70,336	70,336	
2/	70,336 <u>50</u> 3516,8	7033,6	There are 7034 bricks are required. <i>Daar is 7034 stene nodig.</i>
			<b>Beam filling centre line / Balkvulling hartlyn</b>
			2 x 6 000 = 12 000 mm
			2 x 7 000 = <u>14 000 mm</u>
			<u>26 000 mm</u>
			Minus 4 x 110 = <u>440 mm</u> 25560 mm
			The centre line is 25,56 metres / <i>Die hartlyn is 25,56 meter.</i>
			Height of the beam filling is 225 mm.
			<i>Hoogte van die balkvulling is 225 mm.</i>
			50 bricks per square meter for a half-brick wall
			<i>50 stene per vierkante meter vir 'n halfsteenmuur</i>
			There is 1 half-brick wall.
			<i>Daar is 1 halfsteenmuur.</i>
1/	25,56 <u>0,225</u> 5,751	5,75 m	
1/	5,751 <u>50</u> 287,5	288	288 bricks are required. <i>Daar is 288 stene nodig.</i>
			<b>Inner wall centre line / Binnemuur hartlyn</b>
			1 x 5000 = 5000
			The centre line is 5,0 metres / <i>Die hartlyn is 5,0 meter.</i>
			Height of the superstructure is 2 800 mm.
			<i>Hoogte van die bobou is 2 800 mm.</i>
			50 bricks per square meter for a half-brick wall
			<i>50 Stene per vierkante meter vir 'n halfsteenmuur</i>



			There is 1 half-brick wall.
			<i>Daar is 1 halfsteenmuur.</i>
1/	5,00 <u>2,8</u> 14	14	
1/	14 <u>50</u> 700	700	700 bricks are required. <i>Daar is 700 stene nodig.</i>
			<b>Total for structure without deductions/ Totaal van struktuur sonder aftrekkings</b>
			Substructure / <i>Onderbou</i> 1666
			Superstructure / <i>Bobou</i> 7034
			Beam filling / <i>Balkvulling</i> 288
			Inner wall / <i>Binnemuur</i> 700
			9688 Bricks / <i>Stene</i>
			<b>Deductions / Aftrekkings</b>
			<b>Doors / Deure</b>
			2 X 2 X 0,9
			50 bricks per square metre for a half-brick wall
			<i>50 stene per vierkante meter vir 'n halfsteenmuur</i>
			There are 3 half-brick walls.
			<i>Daar is 3 halfsteenmure.</i>
2/	2 <u>0,9</u> 3,6	3,6 M	
3/	3,6 <u>50</u> 180	540	540 bricks are required. <i>Daar is 540 stene nodig.</i>
			<b>Windows / Vensters</b>
			<b>WINDOW A / VENSTER</b>
			2 X 2 X 1.5
			50 bricks per square metre for a half-brick wall
			<i>50 stene per vierkante meter vir 'n halfsteenmuur</i>

			There are 2 half-brick walls. <i>Daar is 2 halfsteenmure.</i>
2/	2 <u>1.5</u> 3	6 m	
2/	6 <u>50</u> 300	600	600 bricks are required <i>Daar is 600 stene nodig</i>
			<b>WINDOW / VENSTER B</b> <b>3 x 0.900 x 1.5</b>
			50 bricks per square metre for a half-brick wall <i>50 stene per vierkante meter vir 'n halfsteenmuur</i>
			There are 2 half-brick walls. <i>Daar is 2 halfsteenmure.</i>
3/	0.9 <u>1.5</u> 1,35	4,05 m	
2/	4,05 <u>50</u> 202,5	405	405 bricks are required. <i>Daar is 405 stene nodig.</i>
			<b>Total deductions / Totale aftrekkings</b>
			Doors / Deure 540 Windows / Vensters <u>1005</u> 1545 Bricks / Stene
			<b>Total bricks for the structure</b> <b>Totale stene vir die struktuur</b>
			Structure / Struktuur 9688 Deductions / Aftrekkings <u>1545</u> 8141
			<b>Plus 5% Wastage / Vermorsing</b>
			8141 <u>0,05</u> 407,5
			8141 plus <u>408</u> 8549
			<b>8549 bricks will be required for the structure.</b> <b><i>Daar sal 8549 stene nodig wees vir die struktuur.</i></b>

**QUESTION 4 / VRAAG 4**

4.1

**Vertical section through columns and beam  
*Vertikale snit deur kolomme en balk***

Vertical section	4	<i>Vertikale snit</i>
Main bars correctly placed	3	<i>Hoofstawe korrek geplaas</i>
Anchor bars correctly placed	3	<i>Ankerstawe korrek geplaas</i>
Shear force bars correctly placed	3	<i>Skuifstawe korrek geplaas</i>
8 stirrups for shear force correctly placed on 150 mm heart to heart	9	<i>8 beuels vir skuifwapening korrek op 150 mm hart-op-hart geplaas</i>
5 stirrups on 300 mm heart to heart	2	<i>5 beuels van 300 mm hart-op-hart</i>
Main reinforcement for columns	4	<i>Hoofbewapening vir kolomme</i>
Joining of the main reinforcement correctly shown	6	<i>Hegting van hoofbewapening korrek getoon</i>
18 stirrups in position for columns (9 per column)	8	<i>18 beuels in posisie vir kolomme (9 per kolom)</i>
Labelling	2	<i>Byskrifte</i>
Dimensioning	2	<i>Afmetings</i>
Neatness	2	<i>Netheid</i>
Line work	2	<i>Lynwerk</i>

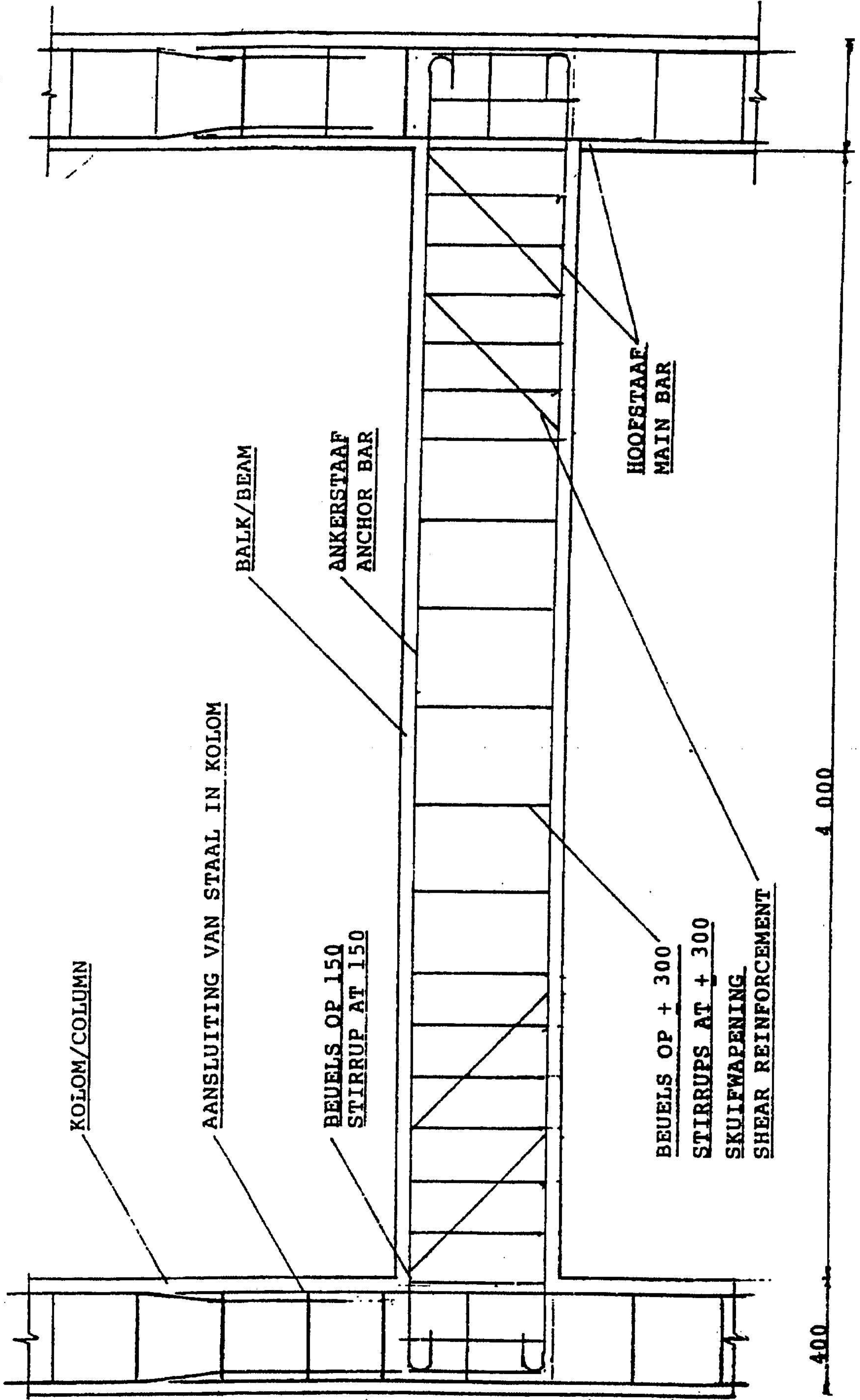
**[50]**

4.2

**Horizontal section through column  
*Horisontale snit deur kolom***

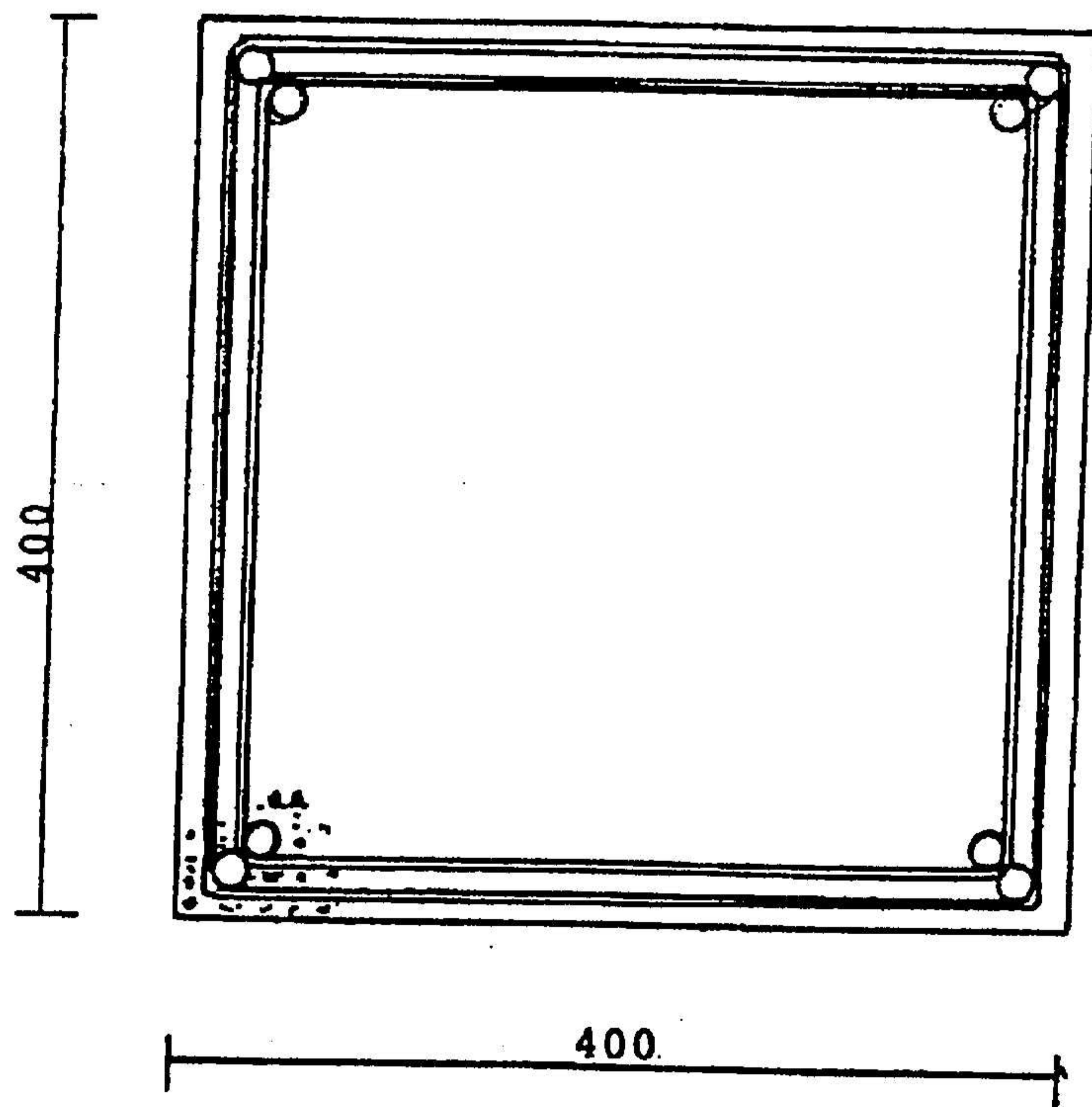
Horizontal section	2	<i>Horisontale snit</i>
Main reinforcing shown	2	<i>Hoofbewapening getoon</i>
Main reinforcing at joint shown	2	<i>Hoofbewapening by hegting getoon</i>
Two sets of stirrups shown	2	<i>Twee stelle beuels in posisie</i>
Scale	1	<i>Skaal</i>
Neatness and line work	1	<i>Netheid en lynwerk</i>

**[10]**



SKAAL/SCALE 1:20

VRAAG / QUESTION 4.2



SKAAL/SCALE 1:5

## QUESTION / VRAAG 5

Take moments about P / *Neem momente om P*

LOM = ROM

$$Q \times 10 \text{ m} = (9 \text{ kN} \times 1,5 \text{ m}) + (7 \text{ kN} \times 6 \text{ m}) + (6 \text{ kN} \times 10 \text{ m})$$

$$= 13,5 + 42 + 60 \text{ kN.m}$$

$$Q = \frac{115,5 \text{ kN.m}}{10 \text{ m}}$$

$$Q = 11,55 \text{ kN}$$

(7)

Take moments about Q / *Neem momente om Q*

LOM = ROM

$$P \times 10 \text{ m} = (6 \text{ kN} \times 0 \text{ m}) + (7 \text{ kN} \times 4 \text{ m}) + (9 \text{ kN} \times 8,5 \text{ m})$$

$$= 0 + 28 + 76,5 \text{ kN.m}$$

$$P = \frac{104,5 \text{ kN.m}}{10 \text{ m}}$$

$$P = 10,45 \text{ kN}$$

(7)

Test / *Toets*

Forces up = Forces down

*Opwaartse kragte = afwaartse kragte*

$$P + Q = 9 \text{ kN} + 7 \text{ kN} + 6 \text{ kN}$$

$$22 \text{ kN} = 22 \text{ kN}$$

(3)

SHEAR FORCES AT; / *SKUIFKRAGTE BY;*

$$A- = 0 \text{ kN}$$

$$A = P$$

$$= 10,45 \text{ kN}$$

$$C- = 10,45 - 9 \text{ kN}$$

$$= 1,45 \text{ kN}$$

$$D- = 10,45 - 9 \text{ kN}$$

$$= 1,45 \text{ kN}$$

$$E- = 10,45 - 9 - 7 \text{ kN}$$

$$= -5,55 \text{ kN}$$

$$B = 10,45 - 4,5 \text{ kN}$$

$$= 5,95 \text{ kN}$$

$$C = 10,45 - 9 \text{ kN}$$

$$= 1,45 \text{ kN}$$

$$D = 10,45 - 9 - 7 \text{ kN}$$

$$= -5,55 \text{ kN}$$

$$E = 10,45 - 9 - 7 - 6 + 11,55 \text{ kN}$$

$$= 0 \text{ kN}$$

(17)

BENDING MOMENTS AT; / *BUIGMOMENTE BY*

$$A = P \times 0 \text{ m} = 0 \text{ kN}$$

$$B = (10,45 \times 1,5 \text{ m}) - (4,5 \times 0,75 \text{ m})$$

$$= 15,675 - 3,375 = 12,3 \text{ kN.m}$$

$$C = (10,45 \times 3 \text{ m}) - (9 \times 1,5 \text{ m})$$

$$= 31,35 - 13,5 = 17,85 \text{ kN.m}$$

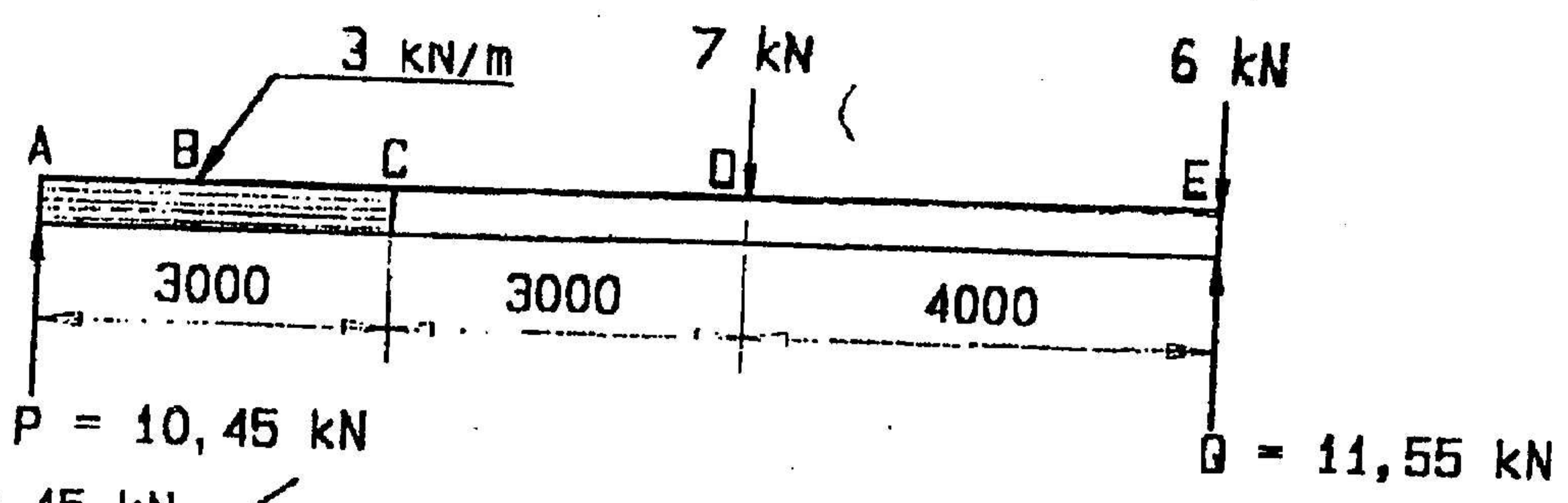
$$D = (10,45 \times 6 \text{ m}) - (9 \times 4,5 \text{ m}) - (7 \times 0 \text{ m})$$

$$= 62,7 - 40,5 = 22,2 \text{ kN.m}$$

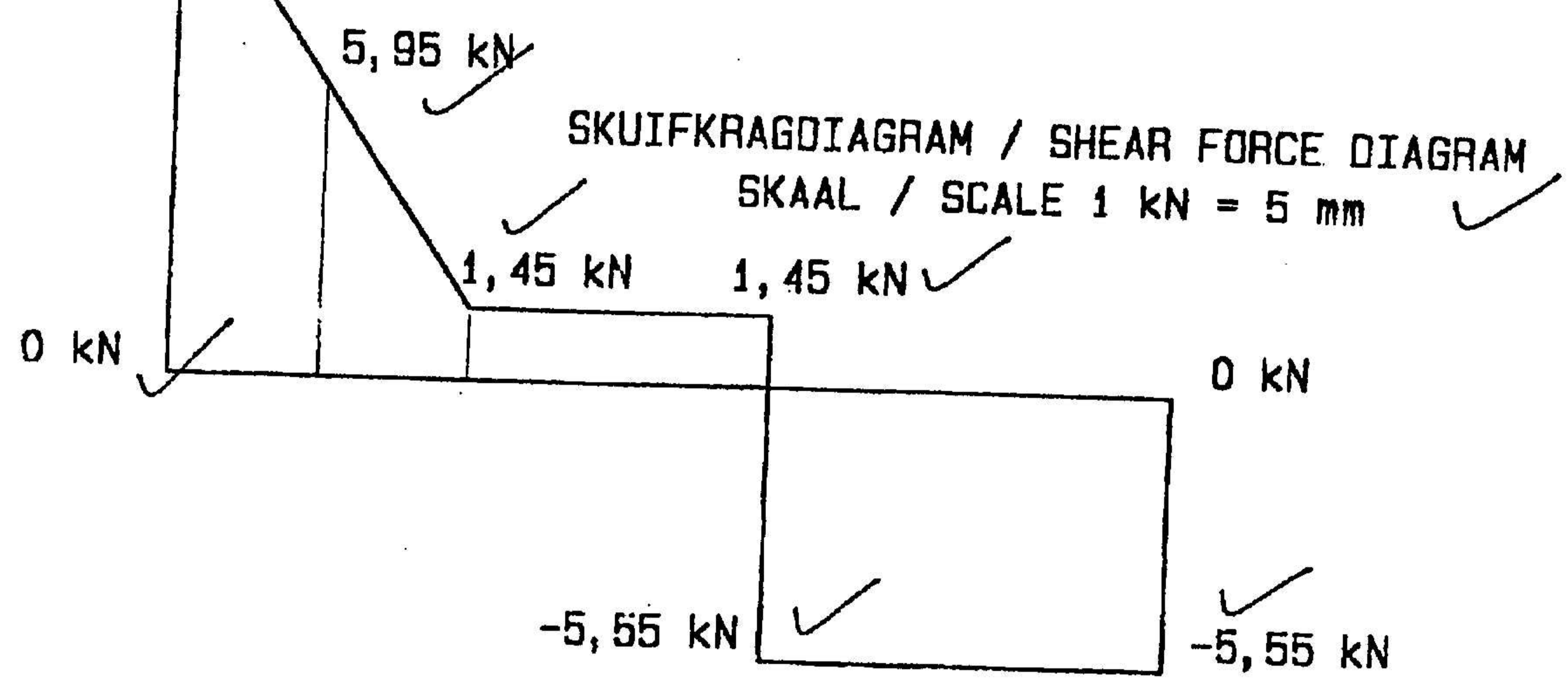
$$E = (10,45 \times 10 \text{ m}) - (9 \times 8,5 \text{ m}) - (7 \times 4 \text{ m}) - (6 \times 0 \text{ m})$$

$$= 104,5 - 76,5 - 28 - 0 = 0 \text{ kN.m}$$

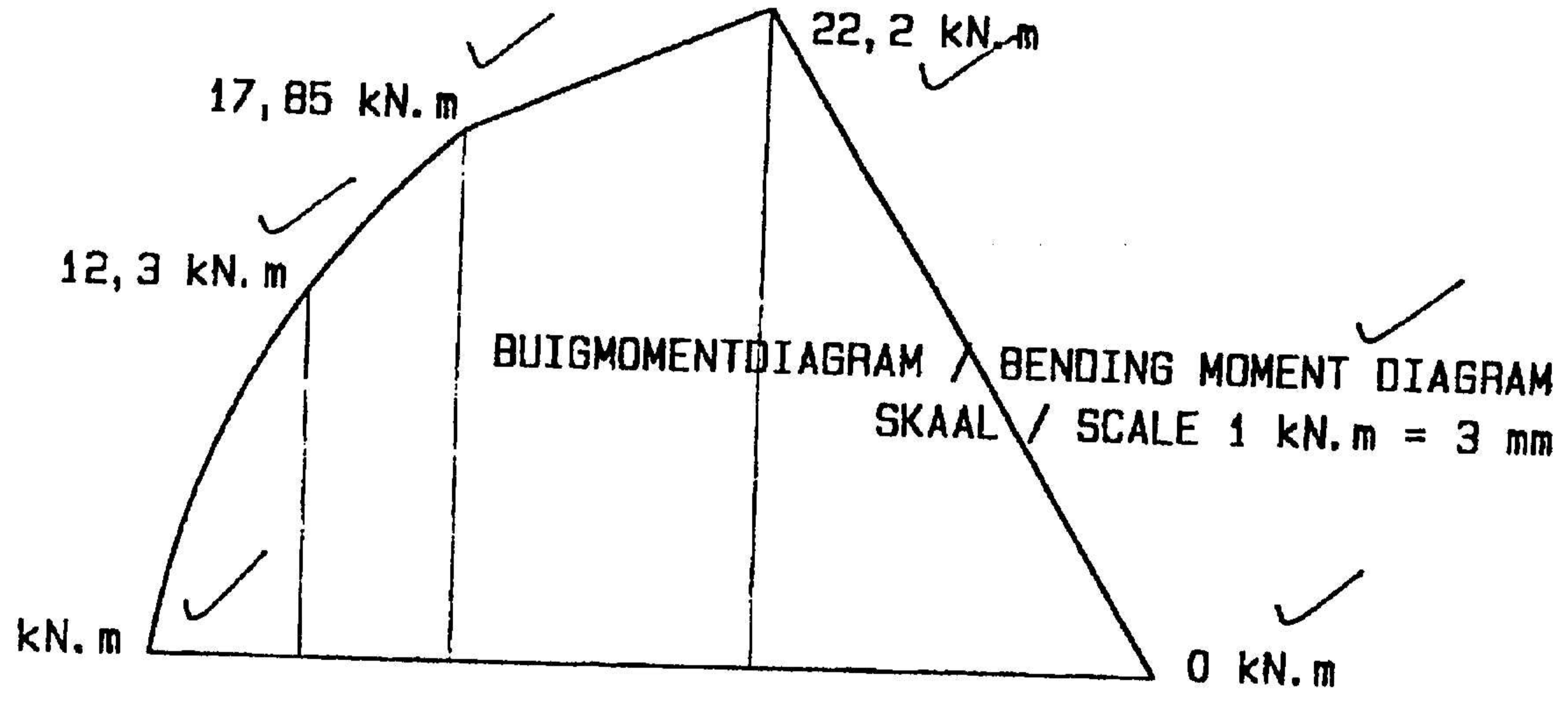
(12)



RUIMTEDIAGRAM / SPACE DIAGRAM  
 SKAAL / SCALE 1:100



8.

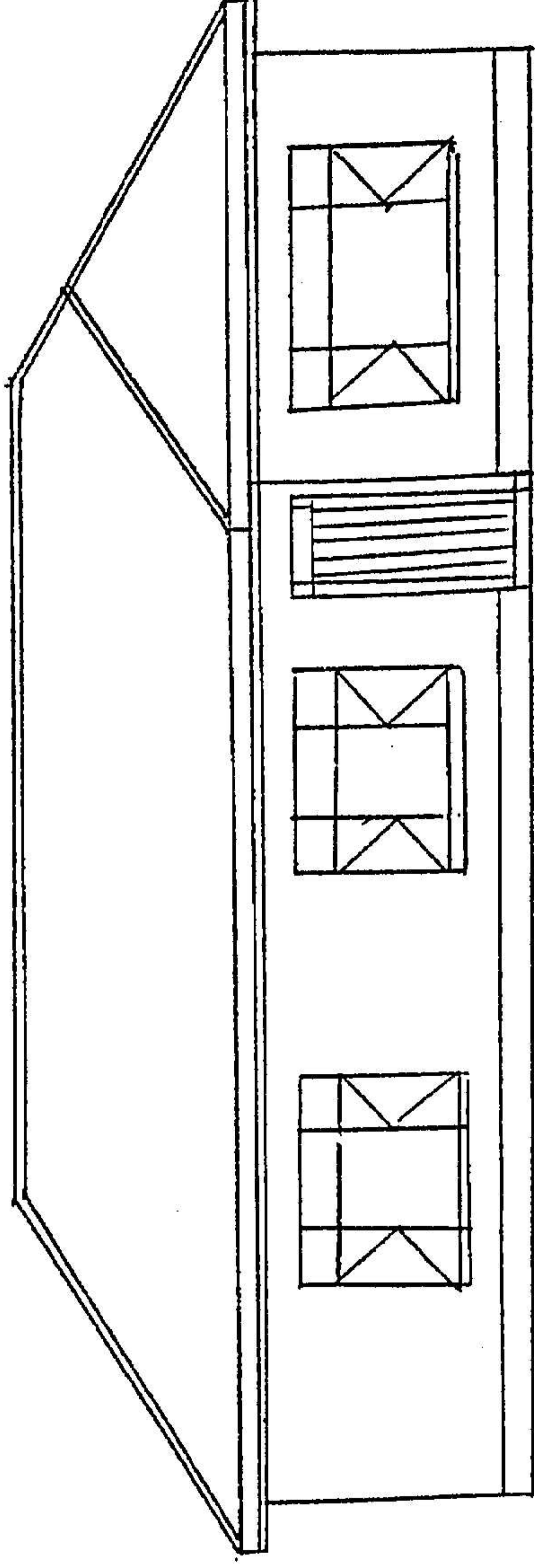
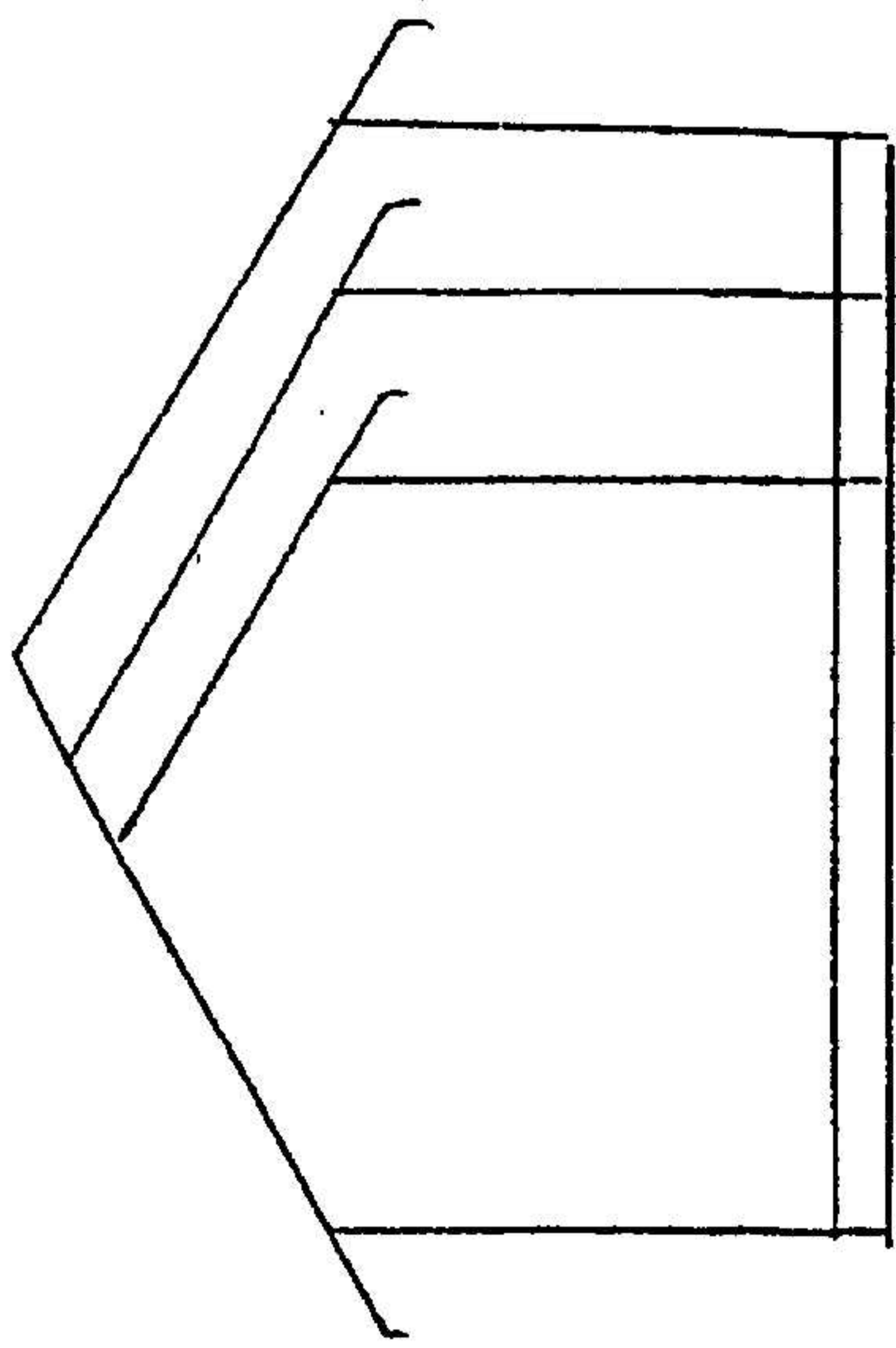


6.

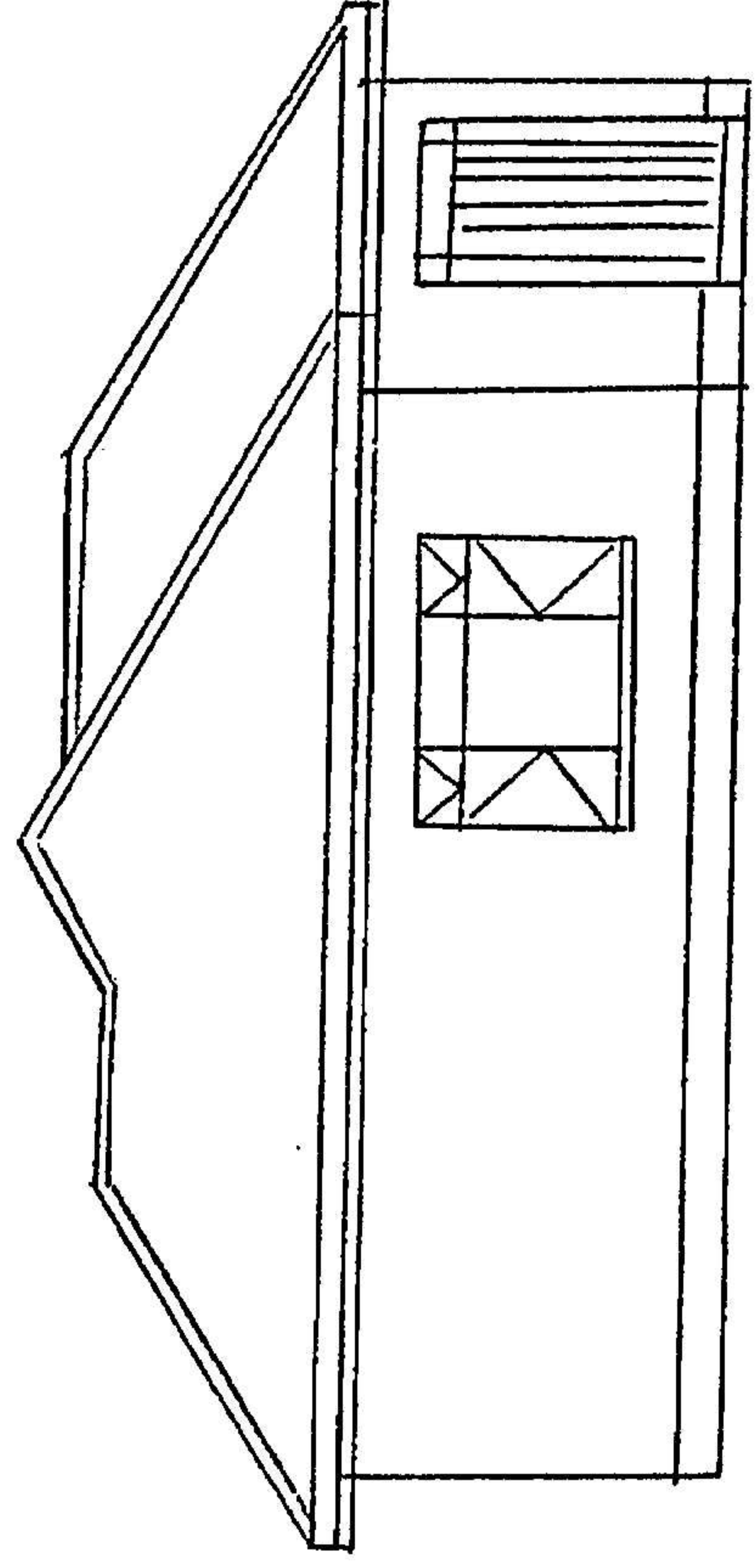




VRAAG 7  
QUESTION 7



NOORD AANSIG.



WES AANSIG.