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

TECHNIKA (CIVIL / *SIVIEL*) HG

Possible Answers / Moontlike Antwoorde
Feb / Mar / Maart 2006

QUESTION 1 / *VRAAG 1*

1.1

1.1.1 It creates hygienic conditions in a town e.g. Sewerage.
Dit skep higiëniese toestande in ? dorp soos bv. rioolwerk.

1.1.2 It creates uniformity e.g. Strength of materials
Dit bring eenvormigheid mee, bv. sterkte van materiale.

1.1.3 The thickness of the walls creates safety for the public.
Die dikte van die mure hou veiligheid vir die publiek in.

1.1.4 It limits overcrowding on a building site.
Dit kan oorbewoning op ? bouperseel beheer.

1.1.5 It safeguards against bad and unsightly designs.
Dit skakel swak ontwerpe en onooglike geboue uit.

TWO MARKS EACH / *TWEE PUNTE ELK*

1.2

1.2.1 The collector must face north at a 35 to 40 degree angle.
Die sonkollektor moet reg noord wys teen ? hoek van 35 tot 40 grade.

1.2.2 Only use an SABS approved collector.
Gebruik net ? kollektor wat deur die SABS goedgekeur is.

1.2.3 The primary circulation pipes must be kept as short as possible without affecting the pressure.
Die primêre sirkulasiepype moet so kort moontlik wees, sonder om die drukhoogte te affekteer.

1.2.4 To prevent heat loss, isolate the primary pipes.
Isoleer die primêre sirkulasiepype om hitteverlies te voorkom.

1.2.5 The collector should never be in the shade.
Die sonkollektor moet nie in die skaduwee wees nie.

1.2.6 The glass panel must be kept clean.
Die glaspaneel moet skoon gehou word.

1.2.7 In municipal areas, the cold water supply to the storage tank, must have a pressure relief valve.
In munisipale gebiede moet die kouewater-toevoer deur ? drukverminderings-klep aan die opgaarsilinder voorsien word.

ANY FIVE. TWO MARKS EACH / *ENIGE VYF. TWEE PUNTE ELK*

1.3

1.3.1 It must be capable of achieving the tensile strength without undue strain.
Dit moet in staat wees om die trekspanning te weerstaan sonder enige noemenswaardige vervorming.

1.3.2 It must be of a material that can easily be bent to any required shape.
Dit moet van ? materiaal wees wat maklik in enige verlangde vorm gebuig kan word.

1.3.3 Its surface must be capable of developing an adequate bond between the concrete and the reinforcement to ensure that the required design tensile strength is obtained.
Die oppervlakte van die bewapening moet in staat wees om ? toereikende verband met die beton te verseker sodat die vereiste ontwerp-trekspanning verkry kan word.

1.3.4 A similar coefficient of thermal expansion is required to prevent unwanted stresses being developed within the member due to temperature changes.
Dit moet ? gelyksoortige warmte-uitsettingskoeffisiënt hê om te verhoed dat onnodige spanning deur temperatuurverandering veroorsaak word.

1.3.5 Availability at a reasonable cost which must be acceptable to the overall design concept.
Dit moet vryelik in die handel beskikbaar wees teen billike pryse en aanpasbaar wees by die ontwerp konsep in sy geheel.

TWO MARKS EACH / *TWEE PUNTE ELK*

1.4

1.4.1 Location of the stand (Environment)
Ligging van die erf (Omgewing)

1.4.2 Slope of the stand
Helling van die grond

1.4.3 Are there municipal services available?
Is munisipale dienste beskikbaar?

1.4.4 Environment pollution
Omgewingsbesoedeling

1.4.5 Main roads and freeways with noise
Hoofpaaie en snelweë met geraas

1.4.6 Formation of the soil
Grondformasie

ANY FIVE. ONE MARK EACH / ***ENIGE VYF. EENPUNT ELK***

1.5

1.5.1 Moisture content of the wood
Voginhoud

1.5.2 Defects in the wood
Defekte in die hout

1.5.3 Length available
Lengtes waarin beskikbaar

1.5.4 Twisting
Buigbaarheid

1.5.5 Grading
Gradering van die hout

TWO MARKS EACH / ***TWEE PUNTE ELK***

1.6

1.6.1 It reduces the water pressure from the municipal water supply to enable water to flow into the geyser if there is an outflow of hot water.
Dit verminder die waterdruk van die munisipale watertoevoer sodat die koue water net by die geiser inloop as die warm water uitvloei.

1.6.2 The steam from the hot water creates pressure in the geyser which is released by means of the relief valve when it becomes too great.
Die stoom van die warm water veroorsaak druk in die geiser wat vrygestel word deur die ontlasklep wanneer die druk te hoog word.

1.6.3 Fullway valve serves as a stopcock in a water supply system and lets water flow through or cuts it off.
Volgang-kleppe dien as ? afsluitkraan in die watertoevoer-stelsel om water deur te laat of af te sny.

TWO MARKS EACH / ***TWEE PUNTE ELK***

1.7

1.7.1 It must be completely impervious.
Dit moet volkome vogwerend wees.

1.7.2 It must be strong.
Dit moet sterk wees.

1.7.3 Must be durable
Dit moet duursaam wees.

1.7.4 Available in comparatively thin sheets
Moet in dun lae beskikbaar wees.

1.7.5 Must be strong enough to support the weight
Moet die gewig van die muur kan dra

1.7.6 Must be able to expand and shrink with the wall
Moet saam met die muur kan uitsit en inkrimp

ANY FOUR. ONE MARK EACH / *ENIGE VIER. EEN PUNT ELK*

1.8 Stress = $\frac{\text{Load}}{\text{Area}}$ *Spanning* = $\frac{\textbf{Belasting}}{\textbf{Deursnee – oppervlakte}}$

$= \frac{80 \times 10^3}{0{,}1 \times 0{,}1}$

= 8 MPa

Change of shape = $\frac{\text{Stress}}{E}$ *Vormverandering* = $\frac{\textit{Spanning}}{E}$

$= \frac{8 \times 10^6}{200 \times 10^9}$

= **0,0004**

MARKS AS SHOWN / *PUNTE SOOS AANGEDUI*

QUESTION 2 / *VRAAG 2*

2.1

GUSSET PLATE		***KNOOPPLAAT***
Seam lap	3	*Naatrand*
Back marks	3	*Kontramerke*
Bolt diameter	2	*Bout-diameter*
Bolt pitch main beam	2	*Boutsteek hoofstaaf*
Bolt pitch struts	2	*Boutsteek stutte*
Gusset plate	2	*Knoopplaat*
Scale	2	*Skaal*
Labels and dimensions	2	*Afmetings en byskrifte*
Neatness	2	*Netheid*
	20	

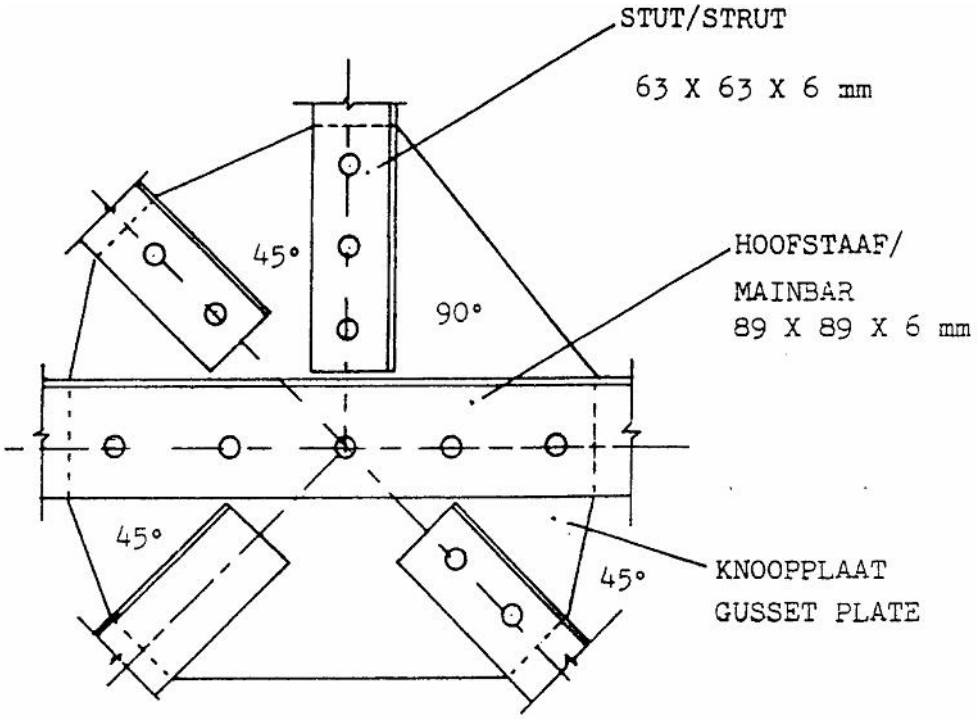
2.2

FOUNDATION WALL		*FONDASIEMUUR*
Foundation strip	1	*Fondasie*
Foundation wall	1	*Fondasiemuur*
Core filling	1	*Puinvulling*
Hardcore	1	*Hardepuin*
Ground level and floor	2	*Grondvlak en vloer*
Blinding	1	*Slytlaag*
Screed	1	*Toplaag*
Damp-proof	1	*Vogweerlaag*
Floor blocks	1	*Blokkiesvloer*
Quarter round	1	*Kwartrond*
Skirting	1	*Vloerlys*
Outer wall	1	*Buitemuur*
Plaster	1	*Pleister*
Line work	2	*Lynwerk*
Labels	2	*Byskrifte*
Neatness	2	*Netheid*
	20	

2.3

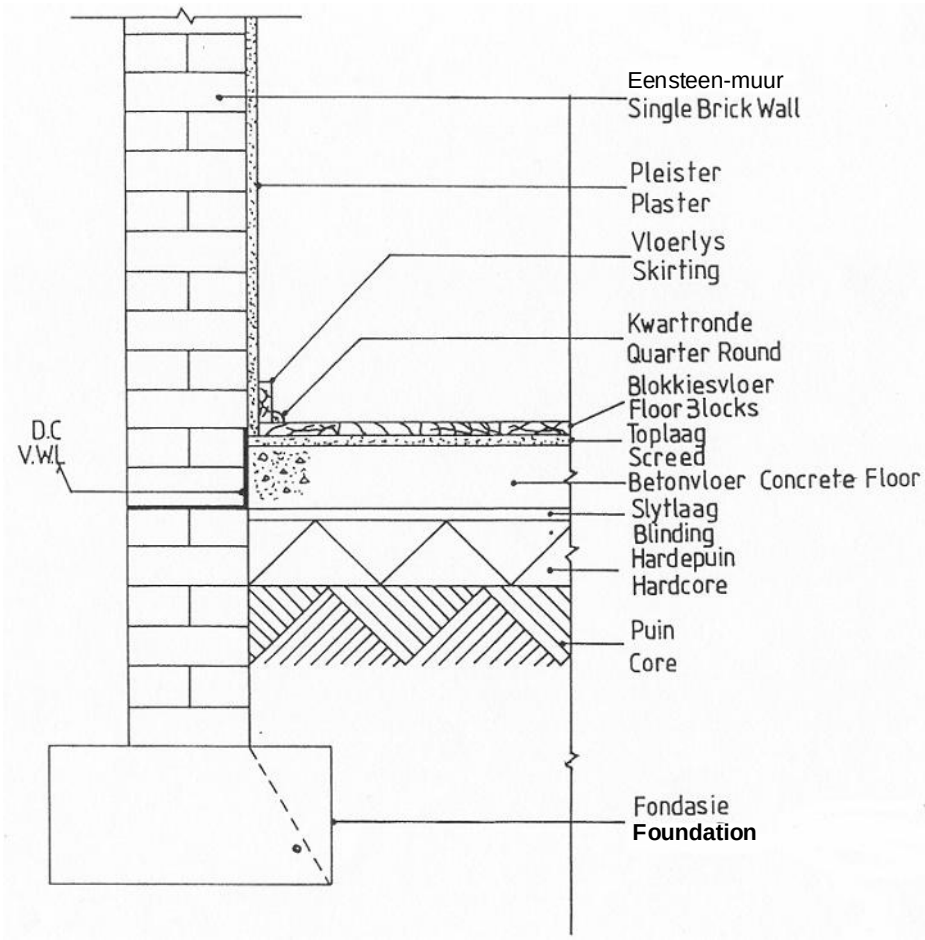
SOLAR HEATING SYSTEM		SON-WATERVERHITTINGSTELSEL
Cold water supply	1	*Koue water-toevoer*
Pressure reducing valve	1	*Drukvermindering-klep*
Full way valves	2	*Volgangkleppe*
Horizontal geyser	1	*Horisontale silinder*
Primary return valve	1	*Primêre terugvoerpyp*
Primary flow	1	*Primêre voerpyp*
Isolation shown	1	*Isolasie getoon*
Solar collector	1	*Sonkollektor*
Pressure relief valves	1	*Ontlaskleppe*
Hot water taps	1	*Warmwater-tappunte*
Arrows showing flow	2	*Pylpunte vir vloei*
Drain cock	1	*Dreineringskraan*
Inter connection	1	*Tussenverbinding*
Hot-water cylinder	1	*Warmwater-silinder*
Neatness	2	*Netheid*
Labels	2	*Byskrifte*
	20	

2.1

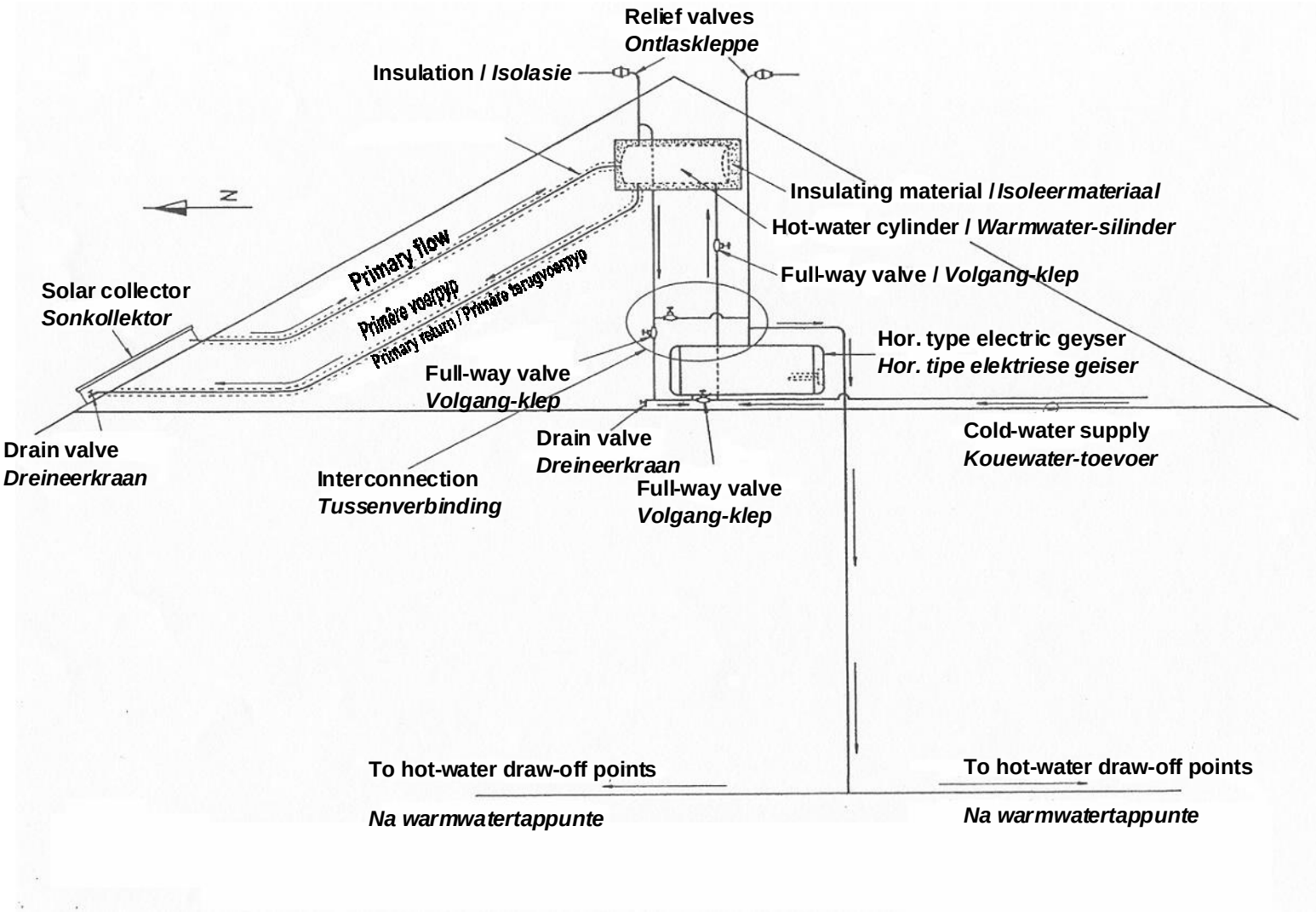


MARKS AS SHOWN / *PUNTE SOOS AANGEDUI*

2.2



MARKS AS SHOWN / *PUNTE SOOS AANGEDUI*



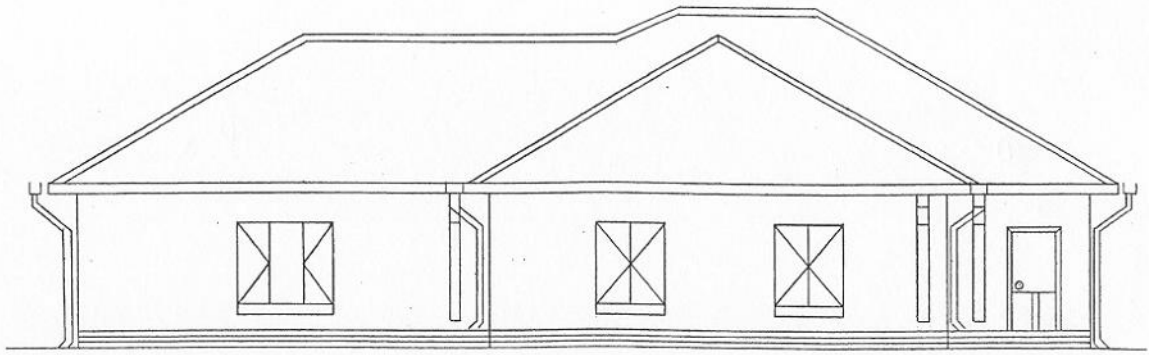
SOLAR WATER HEATING SYSTEM INTERCONNECTED WITH AN ORDINARY HORIZONTAL-TYPE ELECTRIC GEYSER
SON-VERHITTINGSTELSEL TUSSENVERBIND MET GEWONE HORISONTALE TIPE ELEKTRIESE GEISER
MARKS AS SHOWN / *PUNTE SOOS AANGEDUI*

QUESTION 3 / *VRAAG 3*

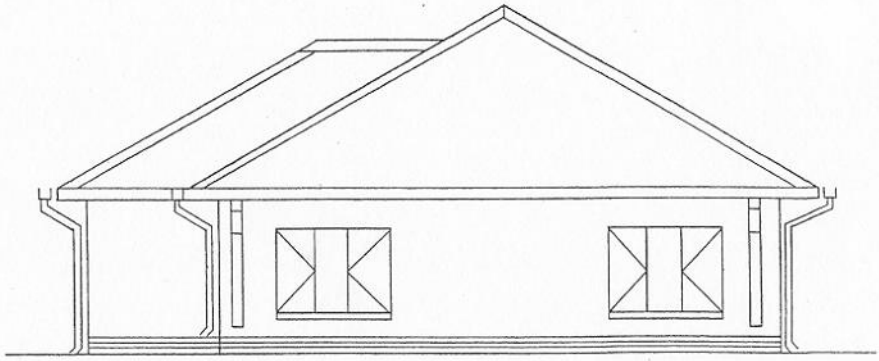
DWELLING PLAN / *HUISPLAN*

SOUTH ELEVATION		*SUID-AANSIG*
Determining roof height	2	*Dakhoogte-bepaling*
Substructure	2	*Onderbou*
Superstructure	2	*Bobou*
Window placing	2	*Vensterplasing*
Window openers	2	*Venster-oopmakers*
Window sills	2	*Vensterbanke*
Door	2	*Deur*
Door casing	2	*Deurkosyn*
Step	2	*Trappie*
Fascia board	2	*Fassieplank*
Gutters	2	*Geut*
Downpipes	2	*Afleipype*
Roof construction	2	*Dakkonstruksie*
Ridge cap	2	*Nokplaat*
Overhang	2	*Oorhang*
Linework	2	*Lynwerk*
Scale	2	*Skaal*
Neatness	2	*Netheid*
	36	

EAST ELEVATION		OOS-AANSIG
Substructure	2	*Onderbou*
Superstructure	2	*Bobou*
Windows	2	*Vensters*
Window sills	2	*Vensterbanke*
Window openers	2	*Venster-oopmakers*
Roof construction	2	*Dakkonstruksie*
Gutters	2	*Geute*
Downpipes	2	*Afleipype*
Overhand	2	*Oorhang*
Scale	2	*Skaal*
Neatness	2	*Netheid*
Labels	2	*Byskrifte*
	24	



SOUTH ELEVATION **SCALE/*SKAAL*= 1:100** ***SUID-AANSIG***



EAST ELEVATION ***OOS-AANSIG***

MARKS AS SHOWN / *PUNTE SOOS AANGEDUI*

QUESTION 4 / *VRAAG 4*

Calculate P ***Bereken P***

Take moments about Q *Neem momente om Q*

L.O.M. = R.O.M.

P x 9 = (E x 1,5) + (D x 3) + (C x 6) + (B x 7,5)
9P = (6 x 1,5) + (4 x 3) + (5 x 6) + (6 x 7,5)
9P = 9 + 12 + 30 + 45
9P = 96
P = $\frac{96}{9}$
P = 10,67 kN

Calculate Q ***Bereken Q***

Take moments about P *Neem momente om P*

L.O.M. = R.O.M.

Q x 9 = (B x 1,5) + (C x 3) + (D x 6) + (E x 7,5)
9Q = (6 x 1,5) + (5 x 3) + (4 x 6) + (x 7,5)
9Q = 9 + 15 + 24 + 45
9Q = 93
Q = $\frac{93}{9}$
Q = 10,33 kN

TEST / *TOETS*

Upward forces = Downward forces
Opwaartse kragte = *Afwaartse kragte*

6 kN + 5 kN + 4 kN + 6 kN = 10,67 kN + 10,33 kN
21 kN = 21 kN

Calculate Bending moments ***Bereken Buigmoment***

BMA = P x O
= 10,67 x 0
= 0 kN/m

BMB = (P x 1,5) - (y x 0,75
= (10,67 x 1,5) – (3 x 0,75)
= 16 – 2,25
= 13,75 kN/m

BMC = (P x 3) – (B x 1,5)
= (10,67 x 3) – (6 x 1,5)
= 32,01 – 9
= 23,01 kN/m

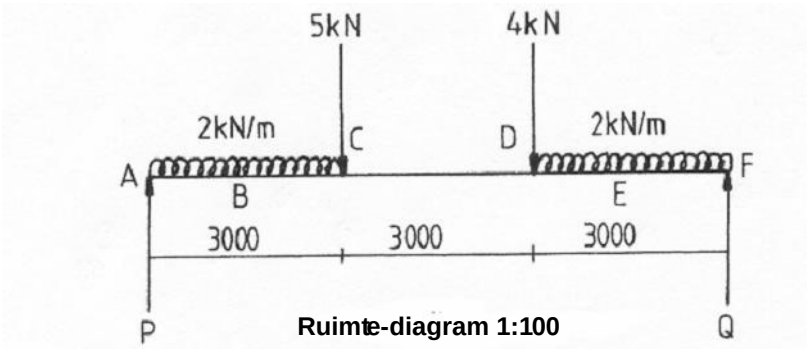
BMD = (P x 6) – (C x 3) – (B x 4,5)
= (10,67 x 6) – 5 x 3) – 6 x 4,5)
= 64,02 – 15 - 27
= 22,02 kN/m

BME = (P x 7,5) – (Z x 0,75) – (D x 1,5) – (C x 4,5) – (B x 6)
= (10,67 x 7,5) – (3 x 0,75) – (4 x 1,5) – (5 x 4,5) – (6x6)
= 80,03 – 2,25 - 6 – 22,5 – 36
= 13,28 kN/m

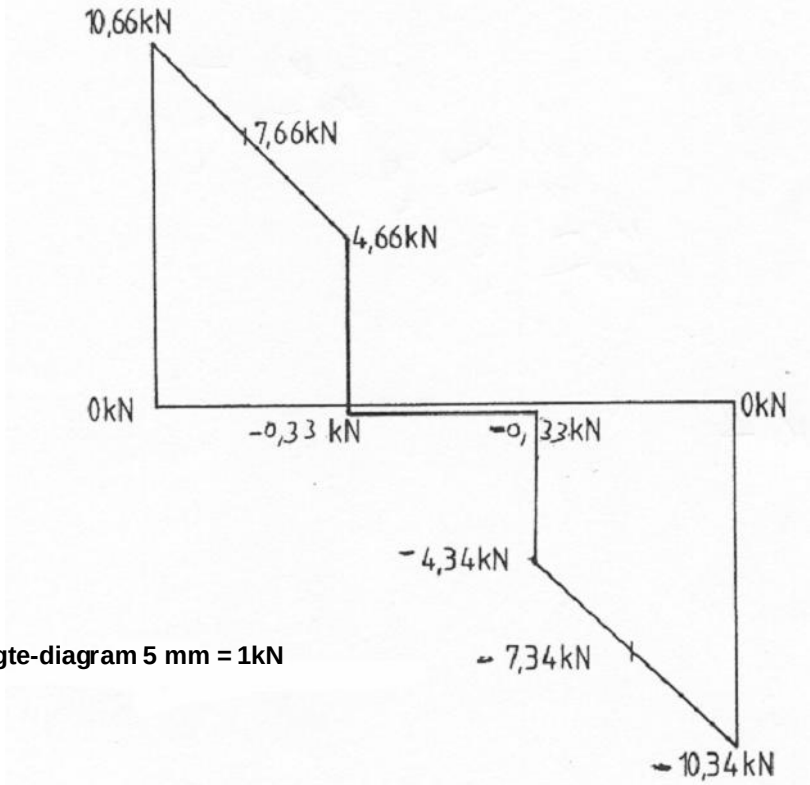
BMF = (P x 9) – (E x 1,5) – (D x 3) – (C x 6) – (B x 7,5)
= (10,67 x 9) – (6 x 1,5) – (4 x 3) – (6 x 7,5)
= 96,03 – 9 – 12 – 30 – 45
= 0 kN/m

Calculate Shear forces **Bereken Skuifkragte**

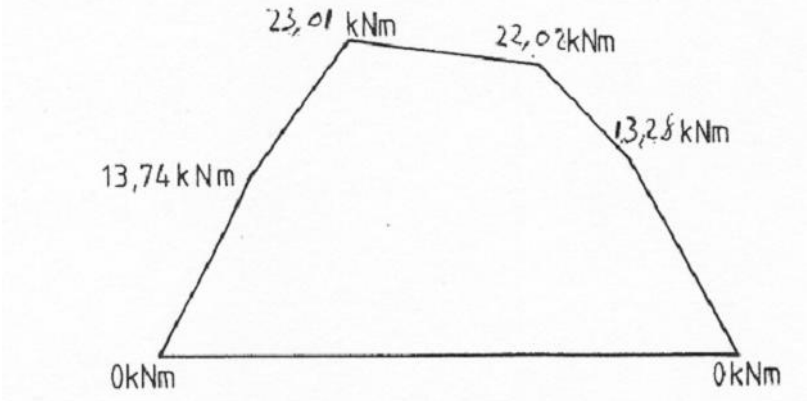
SKA^- / SFA^-	=	0 kN				
SKA^+ / SFA^+	=	10,67 kN				
SKB^+/ SFB^+	=	10,67 – 3	=	7,67 kN		
SKC^- / SFC^-	=	10,67 – 6	=	4,67 kN		
SKC^+ / SFC^+	=	10,67 – 6 – 5	= -	0,33 kN		
SKD^- / SFD^-	=	10,67 – 6 – 5	=	0,33 kN		
SKD^+ / SFD^+	=	10,67 – 6 – 5 – 4	=	- 4,33 kN		
SKE^+ / SFE^+	=	10,67 – 6 – 5 – 4 – 3	=	- 7,33 kN		
SKF^- / SFF^-	=	10,67 – 6 – 5 – 4 – 6	=	10,33 kN		
SKF^+ / SFF^+	=	10,67 – 6 – 5 – 4 – 6 + 10.33	=	0 kN		



Ruimte-diagram 1:100



Skuifkragte-diagram 5 mm = 1kN



Buigmomentdiagram 2 mm = 1 kNm

MARKS AS SHOWN / *PUNTE SOOS AANGEDUI*

QUESTION 5 / *VRAAG 6*

Calculate P ***Bereken P***

Take moments about Q *Neem momente om Q*

L.O.M.	=	R.O.M.
(P x 12)	=	(5 x 4) + (7 x 8)
12 P	=	20 + 56
12P	=	76
P	=	$\frac{76}{12}$
P	**=**	**6,33 kN**

Calculate Q ***Bereken Q***

Take moments about P *Neem momente om P*

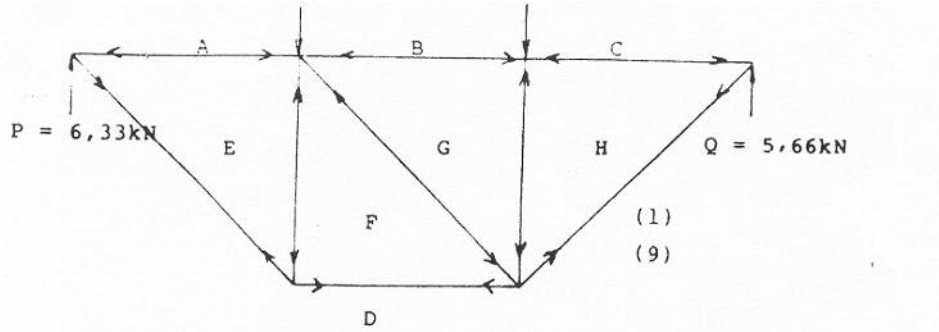
L.O.M.	=	R.O.M.
Q x 12	=	(7 x 4) + (5 x 8)
12 Q	=	28 ÷ 40
12 Q	=	68
Q	=	$\frac{68}{12}$
Q	**=**	**5,66 kN**

Test ***Toets***

Upward forces = Downward forces *Opwaartse kragte = Afwaartse kragte*

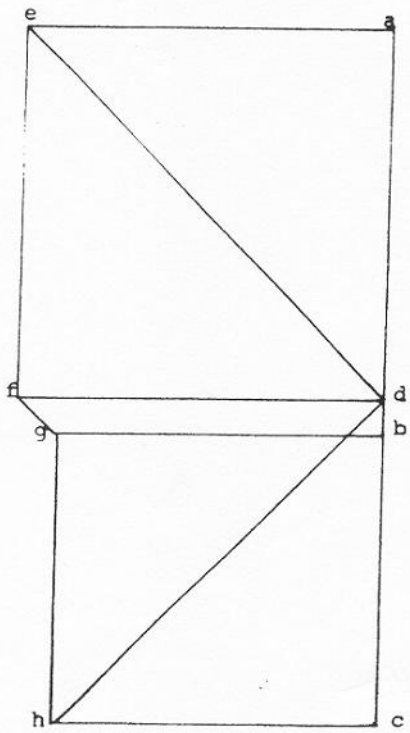
6,33 kN + 5,66 kN	=	7 kN + 5 kN
12 kN	**=**	**12 kN**

MEMBER / *ONDERDEEL*	MAGNITURE / *GROOTTE*	NATURE / *AARD*
AE	**6,45 kN**	**Strut / *Stut***
BG	**5,8 kN**	**Strut / *Stut***
CH	**5,8 kN**	**Strut / *Stut***
DE	**9,0 kN**	**Tie / *Stang***
DF	**6,45 kN**	**Tie / *Stang***
DH	**8,2 kN**	**Tie / *Stang***
EF	**6,4 kN**	**Strut / *Stut***
FG	**o,9 kN**	**Strut / *Stut***
GH	**5,0 kN**	**Strut / *Stut***



(1)

(9)



FORCE / ***KRAGTE-DIAGRAM***
SCALE / ***SKAAL*** **; 10 mm = 1 kN**

(4)

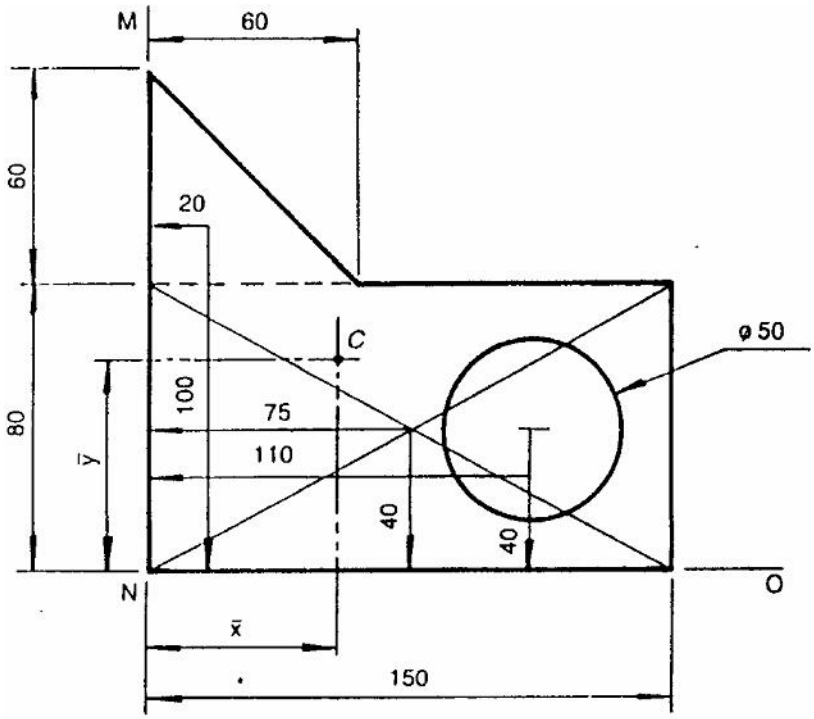
(9)

(13)

MARKS AS SHOWN / ***PUNTE SOOS AANGEDUI***

QUESTION 6 / *VRAAG 6*

6.1



Area van soliede reghoek = 150 mm x 8 mm ü
= 12 000 mm ü

Area van driehoek = ½ x 60 mm x 60 mm ü
= 1 800 mm ü

Area van sirkel = $\frac{3{,}142 \times 50}{4}$ ü
= 1 963,495 ü

Take moments about NO ***Neem momente om NO***

(12 000 mm + 1 800 mm – 1 963,495) x x = (12 000 x 40) + (1 800 x 100) – (1 963,495 x 40) ü

11 836,505 x x = 480 000 + 180 000 – 78 539,8 ü

x = $\frac{581\ 460{,}2}{11\ 836{,}505}$ ü

x = **49,124 mm** ü

Take moments about MN ü *NEEM MOMENTE OM MN*

(12 000 + 1 800 – 1 963,495) x y ü = (12 000 x 45) + (1 800 x 20) -ü (1 963,495 x 1100)

11 836,505 x y ü = 900 000 + 36 000 – 215 984,45 ü

$$y = \frac{720\ 015{,}55}{11\ 836{,}505}$$

y = **60,83 mm**

MARKS AS SHOWN / ***PUNTE SOOS AANGEDUI***

GIVEN: ***GEGEE***

A = 1,69
B = 1,55
C=?

C = 1,69 – 1,59
= 0,14
= 1,55 – 0,14
C = 1,44

Distance to staff ***Afstand na die stok***

(A – C) x 100
(1,69 – 1,41) x 100
= 28 meter

6.3

6.3.1 Smooth off the top of the cone and step off the foot piece.
Skraap die bokant van die keël gelyk af en verwyder jou voete van die staalplaat.

6.3.2 Slowly and carefully lift the cone.
Lig die keël stadig en versigtig op.

6.3.3 Carefully turn over the slump test cone and place it next to the cast concrete.
Draai die saktoets-apparaat versigtig om en plaas langs die gegote beton.

6.3.4 Place the temping rod on the slump cone and allow one end above the concrete.
Plaas die stampblok bo-op die saktoets-keël sodat een ent bokant die beton is.

6.3.5 Measure the distance between the bottom of the temping rod and the centre of the top of the concrete to the nearest 5 mm
Meet die afstand tussen die onderkant van die stampblok en die middelpunt van die bo-kant die beton tot die naaste 5 mm.

6.3.6 Repeat this test if you do not obtain a normal drop.
Herhaal hierdie toets as jy nie normale sakking verkry nie.

TEN MARKS / ***TIEN PUNTE***

6.4

6.4.1 Place two pegs (A and B) on a level area about 100 metres apart.
Plaas twee penne (A en B) op ? redelik gelyk terrein ongeveer 100 meter uitmekaar.

6.4.2 Set up the instrument in a position so that it is the same distance from A and B.
Stel die instrument op in ? posisie sodat dit ewe ver van A en B is.

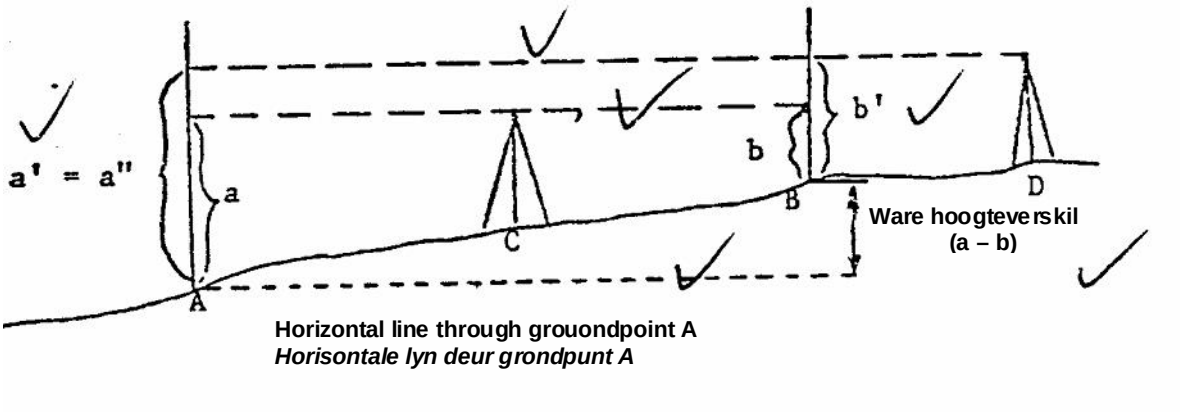
6.4.3 Set the instrument level and take the readings on the rods held at A and B.
The readings are respectively a and b.
The difference in the readings (a – b) will be the real height difference between A and B, even if the instrument has a collimation fault.
With the distances equal, the deviation from the horizontal line on either side will be equal and in the same direction.
The miscalculation is thus corrected.
Stel die instrument waterpas en neem lesings op die stawwe wat by A en B gehou word. Gestel hierdie lesings is a en b.
Die verskil in die lesings (a – b) sal die ware hoogteverskil tussen A en B wees, al het die instrument ? kollimasiefout.
Met die peilingsafstande ewe lank, sal die afwyking van die horisontale lyn aan weerskante ewe groot, en in dieselfde rigting wees.
Hierdeur word die fout dus uitgekanselleer.

6.4.4 Move the instrument and set it up close to one rod and far from the other.
Rod B.
The collimation fault will now show its full effect seeing that the marked distances are not equal in length, and the miscalculations are not corrected.
Verskuif nou die instrument en stel dit op in ? posisie baie naby aan die een staf, en ver van die anders staf af. Staf B.
Die kollimasiefout sal nou sy volle effek toon, aangesien die peilingsafstande nie ewe lank is nie, en dus nie die fout uitkanselleer nie

6.4.5 After the instrument has been set level, the readings close to rod “B” are taken. Point b!
Nadat die instrument waterpas gestel is, word die lesings op die naby staf, staf “B” geneem. Punt b!

6.4.6 With the help of this reading b! and the true height difference (a – b) and no miscalculation present, the reading at “A” is calculated as follows:
True reading on Rod A (a!) = b! + (a – b)
Met behulp van hierdie lesing b! en die ware hoogteverskil (a – b), word die lesing wat op “A” gelees behoort te word, en daar geen berekeningsfout aanwesig is nie, soos volg bereken:
Ware lesing op staf A (a!) = b! + (a – b)

6.4.7 Take the real reading (a!) on the rod A and compare it to the true reading. If both readings, the true and real readings, are the same, then the instrument is set.
Neem nou die werklike lesing (a!) op die staf by A, en vergelyk dit met die berekende of ware lesing.
Indien hierdie twee lesings, die ware en die werklike lesings, ooreenstem, is die instrument ingestel.

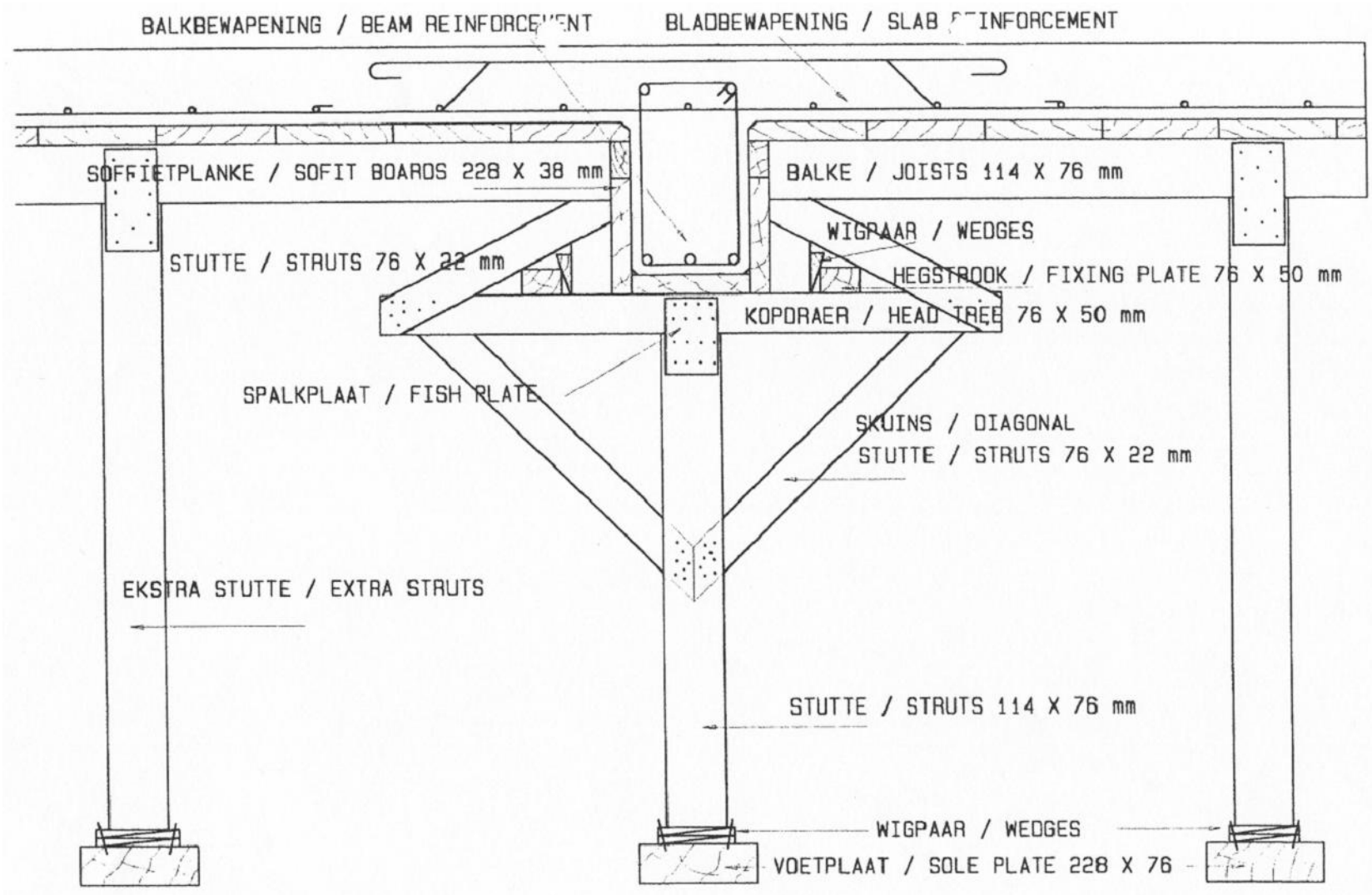


Horizontal line through grouondpoint A
Horisontale lyn deur grondpunt A

TWO MARKS FOR EACH POINT DISCUSSED. SIX MARKS FOR THE SKETCH AS SHOWN.
TWEE PUNTE VIR ELKE PUNT BESKRYF. SES PUNTE VIR DIE SKETS SOOS AANGEDUI

QUESTION 7 / *VRAAG 7*

CONCRETE BEAM AND FLOOR		***BETONBALK EN -VLOER***
BEAM	2	*BALK*
FLOOR	2	*VLOER*
SOFFIT BOARDS	4	*SOFFIETPLANKE*
JOISTS 114 mm x 76 mm	4	*BALKE 114 mm X 76 mm*
CLEATS	2	*KLAMPE*
WEDGES (top)	2	*WIGPAAR (bo)*
FIXING PLATE	2	*HEGSTROOK*
HEAD TREE	2	*KOPDRAER*
STRUT 114 mm x 76 mm	2	*STUT 114 mm x 22 mm*
STRUTS 76 mm x 22 mm	2	*STUTTE 76 mm X 22 mm*
FISH PLATE	2	*SPALKPLAAT*
SOLE PLATE	2	*VOETPLAAT*
WEDGES (bottom)	2	*WIGPAAR (onder)*
EXTRA STRUTS	2	*EKSTRA STUTTE*
BEAM REINFORCING	6	*BALKBEWAPENING*
SLAB REINFORCING	6	*BLADBEWAPENING*
NEATNESS	4	*NETHEID*
SCALE	4	*SKAAL*
DIMENSIONS	4	*AFMETINGS*
LABELS	4	*BYSKRIFTE*
	60	



MARKS AS SHOWN / *PUNTE SOOS AANGEDUI*