Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2015

CIVIL TECHNOLOGY MEMORANDUM

MARKS: **200**

This memorandum consists of 16 pages.

QUESTION 1: CONSTRUCTION PROCESSES

1.1 1.1.1 1.1.A – Site boundary
1.1.B – Building boundary
1.1.C – Base line (3 x 1) (3)

1.1.2 Profile board (1)

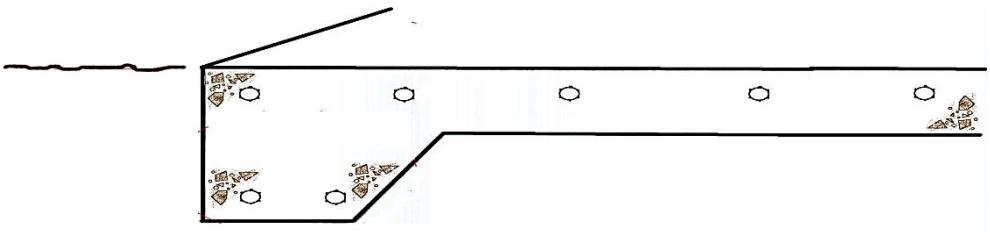
1.1.3 Foundation width and wall thickness (2 x 1) (2)

1.1.4 Any TWO methods to measure corners at a structure square.
- 3 : 4 : 5 method
- Building square
- Electronic/Infra-red square (2 x 1) (2)

1.2 (1) Underground foundations offer more (2) stability / protection against compression / protection against weather circumstances. (2)

1.3 Any FOUR factors which will influence the choice of foundation
- Load-bearing capacity of the ground.
- Depth of suitable load-bearing ground.
- Depth of water-table.
- Distance from trees and other structures.
- Weight of building. (4 x 1) (4)

1.4 Make a neat sketch to illustrate the construction of a raft foundation.



(2)

1.5 1.5.1 Line block – Stringing building lines / Laying of bricks at an even height / level (1)

1.5.2 Tingle – Keeping building lines straight (1)

1.5.3 Long jointer – Jointing of horizontal mortar joints (1)

1.5.4 Belt sander – Levelling large surfaces / Removing marks on wood / Sanding of curves (1)

1.5.5 Thicknesser – Planing planks to a required thickness. (1)

1.6 Any similar answer:
(1) Blocked ventilation openings (2) prevents the electric motor from cooling down / can cause the electric motor overheat. (2)

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1.7 Any TWO uses of the dumpy level:
- Horizontal readings / height differences
- Determination of slopes
- Distance measuring (2 x 1) (2)

1.8 (1) Set up level (2) through 360º (2)

1.9 Any THREE advantages of a cavity wall:
- Prevents water from penetrating the inner walls
- Good thermal isolation
- No rendering needed for outer walls
- Inner walls can be built with cheaper bricks
- Better sound insolation (3 x 1) (3)

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QUESTION 2: ADVANCED CONSTRUCTION PROCESSES

2.1 (1) Bottom side of concrete beam is subjected to tensile stress.
(2) Concrete is weak under tensile stress and (3) steel is strong under tensile stress. (3)

2.2
- Bent up bars over shear line
- Stirrups over shear line (2 x 1) (2)

2.3 Any similar answer:
(1) Depth of concrete (2) over steel reinforcement. (2)

2.4 2.4.1 4 (1)

2.4.2 6 (1)

2.5 Any FIVE advantages of laminated shuttering boards:
- Economical
- Easy to handle
- Larger sheets give better finish
- Larger sheets require fewer joints
- Rigid
- No unnecessary expansion and shrinking (5 x 1) (5)

2.6 Make a neat sketch on a scale 1 : 10 of an open-eave construction with beam filling and indicate the following parts:

2.6.1 Single brick wall construction (1)

2.6.2 Wall plate (1)

2.63 Rafter (1)

2.6.4 Tie beam (1)

2.6.5 Purlin (1)

2.6.6 Roof sheet (1)

2.6.7 Fascia board (1)

2.6.8 Beam filling (1)

2.6.9 Correct scale (2)

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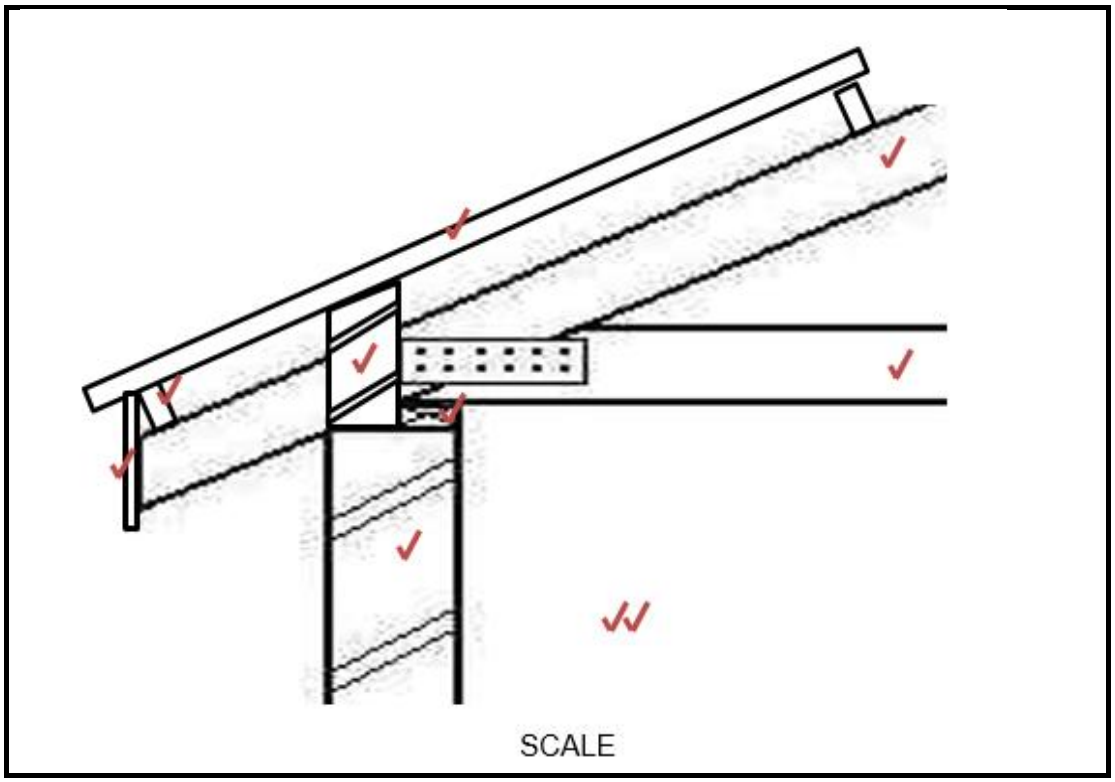

2.7 Type / Weight of roof covering (1)

2.8 Any THREE situations where shoring is generally used:

- (1) To support walls (2) which are unstable.
- (1) To support walls where (2) structural changes are being carried out
- (1) To support walls (2) where the bottom part of the wall must be demolished.
- (1) To support walls where (2) furrows being dug close to foundations
- (1) To support adjacent walls where (2) structures are being demolished.
- (1) To give support to (2) a floor or roof for work to the load-bearing wall. (3 x 2) (6)

2.9 Any THREE types of shoring which are generally used:

- Raking shores
- Flying shores
- Dead shores (3 x 1) (3)

2.10 2.10.1 Voussoirs

2.10.2 Intrados

2.10.3 Key brick

2.10.4 Extrados

2.10.5 Abutment

2.10.6 Span (6)

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QUESTION 3: CIVIL SERVICES

3.1 Raising water pressure. (1)

3.2 3.2.1 Ø20 mm

3.2.2 Ø12 mm (1)

3.3 Similar answer:
(1) Black colour prevents (2) heat from being emanated (absorb heat). (2)

3.4 (1) Sharpens the sun beams. (2) Prevents the dust from covering the parts. (2)

3.5 Any THREE advantages of polythene pipes for water supply:
- Resistance to chemicals
- Flexible / Easily laid around bends
- Cheap
- Light in weight
- Easy to install (3 x 1) (3)

3.6 3.6.1 Screwed threads (1)

3.6.2 Glued / Clamps / Ball and spigot joint (1)

3.6.3 Fittings soldered together / Brass compression fittings (1)

3.7 3.7.1 False (1)

3.7.2 False (1)

3.7.3 True (1)

3.7.4 True (1)

3.7.5 True (1)

3.8 (1) Amount of outflow / Number of persons.
(2) Absorption ability of the soil (2 x 1) (2)

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3.9
- Plug the lower end of the drain.
- Pour in water at the highest point until the pipe is full.
- Leave it for two hours.
- Check water level.
- Top the water level up.
- Check water level after half an hour – If the level has dropped less than 6 mm, there are no leaks. (6 x 1) (6)

3.10 Any FOUR advantages of PVC-drain pipes:
- Light weight
- Long lengths available
- Less joining work
- Tight joints
- Easy to handle / Install
- Good flow efficiency
- Resist most chemicals (Any 4 x 1) (4)

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QUESTION 4: MATERIALS AND QUANTITIES

4.1
- When necessary to remove shuttering prematurely.
- Cold weather (2)

4.2 (1) Chemical reaction (2) Physical reaction / Cement hardens (2)

4.3 (1) Cement can react with moisture (2) in the air / hardened / becomes unusable (2)

4.4 4.4.1 Plasticisers – Lend workability to mix / Reduce amount of water needed / Less water – greater strength. (1)

4.4.2 Air-entraining agents – Improve workability / Tiny bubbles improve frost resistance. (1)

4.4.3 Retarders – During hot weather / When transporting over long distances. (1)

4.5
- Throw stone in mixing drum.
- Add some water.
- Add cement.
- Add sand.
- Add rest of water. (5)

4.6 Removing air bubbles / Distribute concrete evenly (1)

4.7 Test workability of concrete / Determine water content of mix. (1)

4.8 4.8.1 Veneer (1)

4.8.2 Plywood (1)

4.8.3 Block board (1)

4.9 Any THREE advantages of hardboard:
- Large sheets
- Uniform texture
- Different thicknesses
- Can be painted and varnished.
- Can be glued.
- Waste wood can be used optimally.
- Be worked with ordinary woodwork tools. (Any 3 x 1) (3)

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4.10 FIGURE 4.10 on ANSWER SHEET A shows the foundation plan for a structure. Use the quantity list on ANSWER SHEET A and answer the following questions with regard to the foundation:

4.10.1 Determine the centre line of the foundation. (4)

4.10.2 Determine the volume of concrete needed to cast two foundations. (4)

[30]

QUESTION 5: APPLIED MECHANICS

5.1 Determine the centroid from point P of the isosceles triangle in FIGURE 5.1. Show all formulas and calculations.

$$X = \frac{b}{2} = \frac{4}{2} = 2 + 2 + 4$$

$$Y = \frac{h}{3} = \frac{6}{3} = 2 + 3 + 5$$

(4)

5.2 FIGURE 5.2 on ANSWER SHEET B shows a beam with point loads. Determine the following on ANSWER SHEET B:

5.2.1 The bending moment values. (7)

5.2.2 Complete the bending moment diagram according to the bending moment values. (4)

5.3 FIGURE 5.3 on ANSWER SHEET C shows a space diagram of a roof truss. Determine graphically on ANSWER SHEET C the sizes and nature of the parts of the truss by completing the force diagram and the table. (15)

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QUESTION 6: GRAPHICS AND COMMUNICATION

6.1 FIGURE 6.1 on ANSWER SHEET D shows the floor plan of a building which is drawn on a scale 1 : 100 according to the following requirements:

- The gable roof construction with a pitch of 30º.
- Eave incline of 400 mm at all four elevations.
- Wall height of 2,6 m from floor to ceiling.

Use the information on ANSWER SHEET D and draw on ANSWER SHEET D the south elevation of the building on a scale 1 : 100. Draw the south elevation from the given NATURAL GROUND LEVEL-line.
The following detail must be shown:

6.1.1	Roof lines	(2)
6.1.2	Barge board	(3)
6.1.3	Eave incline	(1)
6.1.4	Wall height	(2)
6.1.5	Garage door	(2)
6.1.6	Garage door handle	(1)
6.1.7	Garage ramp	(2)
6.1.8	Window	(2)
6.1.9	Window sill	(1)
6.1.10	Door	(2)
6.1.11	Door handle	(1)
6.1.12	Step	(1)
6.1.13	Floor level	(1)
6.1.14	labels	(2)
6.1.15	Gutters/down pipes	(3)
6.1.16	Neatness	(2)

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6.2 Any FOUR purposes of a site plan:

- Show building lines
- Show servitudes
- Show municipal sewerage connection
- Entrance to the site
- General placement of buildings
- Placing of buildings with regard to reference points and boundary lines.
- Detail of general services / sewerage points / water points
- Location of house in relation to north point / winds
- Number of site and adjacent sites (4)

6.3 6.3.1 Water meter  WM (2)

6.3.2 Inspection eye 

(2)

6.3.3 Grease trap 

(2)

6.3.4 Hard core  HC (2)

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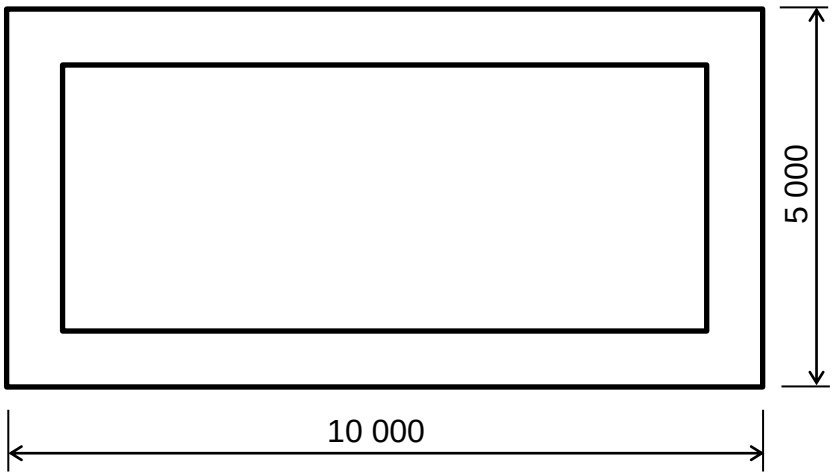
TOTAL: 200

ANSWER SHEET ANTWOORDBLAD **A**	CIVIL TECHNOLOGY SIVIELE TEGNOLOGIE	NAME: NAAM:

QUESTION/VRAAG 4.10



Fondament breedte = 600 mm
Fondament dikte = 200 mm
Foundation width = 600 mm
Foundation thickness = 200 mm

A	B	C	D
			Senterlyn / Centre line:
			✓ ✓ ✓ ✓
			10 000 + 10 000 + 5 000 + 5 000 – (4 x 600) = 27 600 mm
			Volume beton / Volume concrete:
2 ✓	27,6		
	0,6 ✓		✓ (3,312 m³ x 2)
	0,2 ✓	6,624	6, 624 m³ Beton benodig vir twee fondamente.
			Concrete needed for two foundations.

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ANSWER SHEET ANTWOORDBLAD	B	CIVIL TECHNOLOGY SIVIELE TEGNOLOGIE	NAME: NAAM:

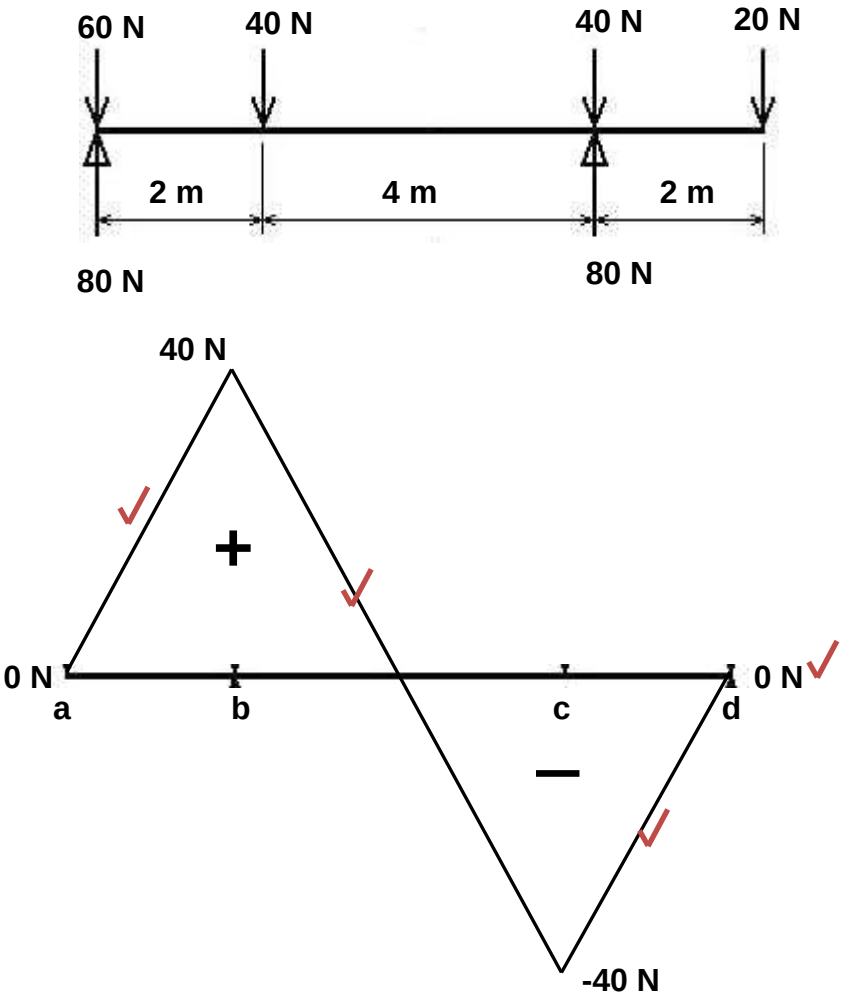
QUESTION/VRAAG 5.2

5.2.1 Die buigmomentwaardes / The bending moment values

a **= …0 N** ✓
b **= …(80 x 2) + (-60 x 2) = 40 N** ✓
c **= …(80 x 6)+(-60 x 6) +(-40 x 4) = -40 N** ✓
d **= …(80 x 8) + (-60 x 8) + (-40 x 6) + (80 x 2) + (-40 x 2) = 0 N** ✓ (7)

5.2.2 Die buigmomentdiagram / The bending moment diagram (5)

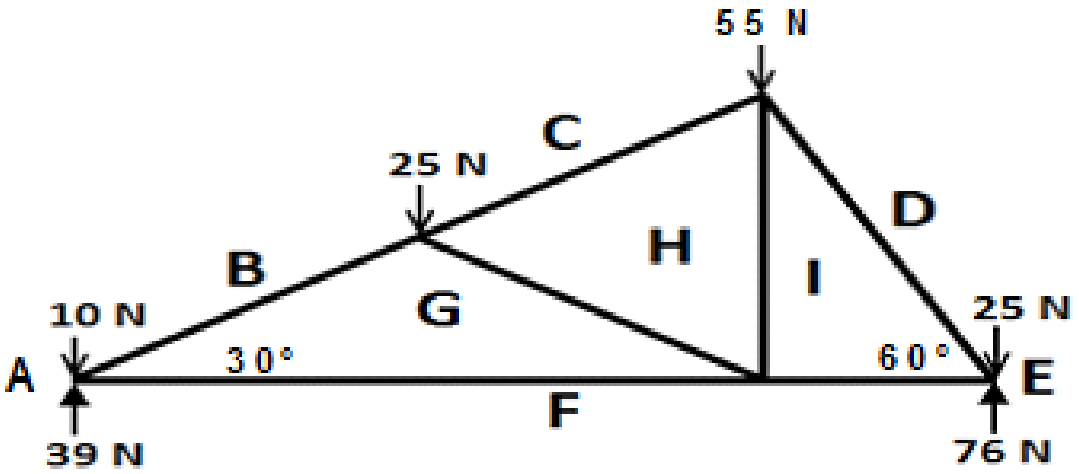
SCALE/SKAAL: 1 N = 1 mm

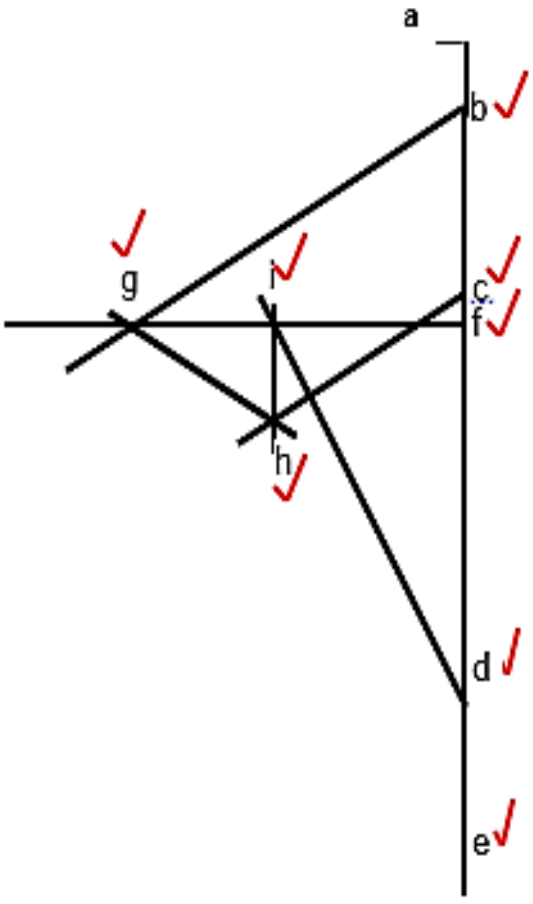


ANSWER SHEET ANTWOORDBLAD	C	CIVIL TECHNOLOGY SIVIELE TEGNOLOGIE	NAME: NAAM:

QUESTION/VRAAG 5.3 **(15)**

SPACE DIAGRAM:
RUIMTE-DIAGRAM:





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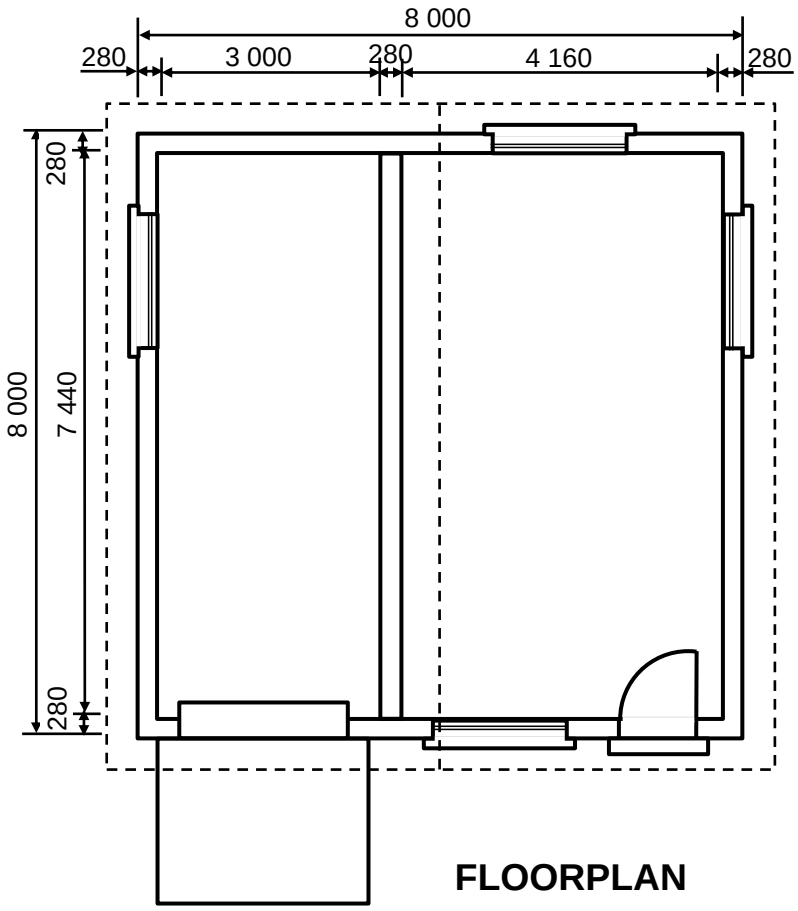
AGTEDIAGRAM
FORCE DIAGRAM

Skaal/Scale: 1 mm = 1 N

DEEL/PART	STUT/STRUT	STANG/TIE
BG	58 N	
CH	34 N	
DI	58 N	
FI		29 N
FG		50 N
GH	25 N	
HI		13 N

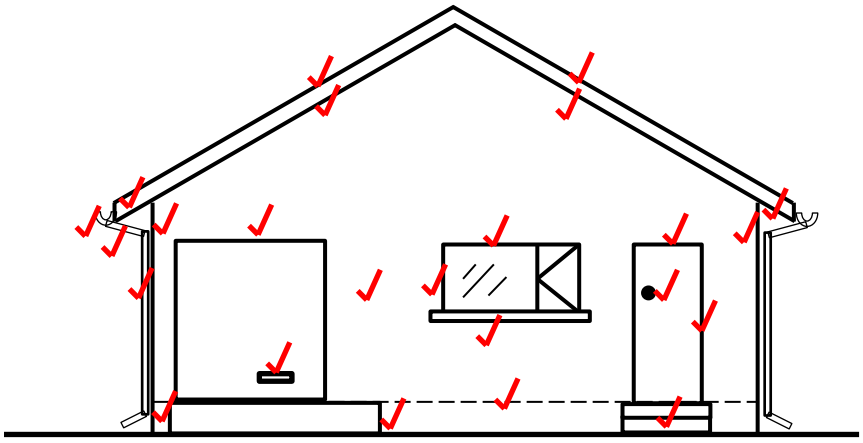
ANSWER SHEET ANTWOORDBLAD	D	CIVIL TECHNOLOGY SIVIELE TEGNOLOGIE	NAME: NAAM:

VRAAG/QUESTION 6.1 **(28)**



FLOORPLAN

SCALE 1 : 100



SOUTH ELEVATION

SCALE 1 : 100

Roof lines	2	
Barge board	3	
Eave incline	1	
Wall height	2	
Garage door	2	
Garage handle	1	
Garage ramp	2	
Window	2	
Window sill	1	
Door	2	
Door handle	1	
Step	1	
Floor level	1	
labels	2	
Gutters/down pipes	3	
Neatness	2	
TOTAL	28	

Neatness

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