N5 Quantity Surveying

Gateways to Engineering Studies - C J Bam & A F May

HYBRID LEARNING SOLUTIONS

Gateways to Engineering Studies

Quantity Surveying
N5

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Published by
Hybrid Learning Solutions (Pty) Ltd
4 Golf Park Building
Mowbray
Tel: 021 460 4488
Email: orders@hybridlearning.co.za

© 2014 Christopher Brink and Associates
First printed 2013
Second edition: 2014

ISBN: 978-1-928203-73-5

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Editor: Chris Brink
Proofreaders: Vanessa Brink
Book design: Chris Brink
Cover design: Sarah Buchanan
Technical Illustrations: RA May
Typesetting and layout: Chris Brink/Sarah Buchanan

Printed and bound by: FormsXpress

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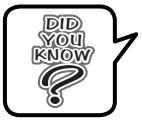	Did you know?		Read
	Example		Safety
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Module 1

The role and responsibilities of a Quantity Surveyor

Learning Outcomes

On the completion of this module the student must be able to:

- Describe the most important duties of a quantity surveyor.
- Describe the most important documents a quantity surveyor would be dealing with as well as their uses.
- Demonstrate the steps to be followed when drafting:
  - interim valuations
  - final accounts

1.1 Introduction

A quantity surveyor may work either for the client or the contractor, working in an office or on site. They are involved in a project from start to the settlement of the final account. Quantity surveyors use their skills to determine the cost of building work.

The quantity surveyor's detailed knowledge of construction costs allow them to perform the following tasks independently of whether they are working for the client or the building contractor.

1.2 Pre-contract duties for a client

These are duties a quantity surveyor performs from the inception of a project to the appointment of a main-contractor for the project.

- The preparation of bills of quantities to assist in the tender process.
- The preparation of schedules of rates to speed up a tender process.
- The preparation of estimates to define project budgets.
- Cost planning and cost control to refine the budget.
- The preparation of specifications when required to do so.
- Assist in the tendering process.
- Assist client and architect with advice regarding the design and building materials.
- Prepare and analyze costs for tenders.

1.3 Post-contract duties for a client

These are the duties a quantity surveyor performs from the appointment of a main-contractor for the project to the finalization of the final account.

- Checking of the main-contractor's priced bills of quantities.
- Control all costs during the construction period.
- Assessment of contractor's claims and preparation of monthly valuations.
- Preparation and negotiate final accounts.

- Valuation of variation orders.
- Assessment of specialist sub-contractor's claims and agree valuations.
- Measure and agree provisional quantities in the bills of quantities.

1.4 Pre-contract duties when working for a contractor

- Preparation of tender price.
- Establish site location, conditions, municipal services available, road entrances and other information useful in the tender process.
- Prepare tender documents from drawings if a bills of quantities is not available.
- Assist when negotiating for a contract.
- Prepare priced bills of quantities.

1.5 Post-contract duties when working for a contractor

- Regular visits to the site to assess working progress.
- Prepare monthly valuations.
- Check on site instructions and variation orders issued.
- Assess work done on day-works with regard to labour, plant and materials used.
- Work with sub-contractors with regard to their monthly claims and negotiate and agree new prices if required.
- Do sub-contractor payments.
- Work closely with the client's quantity surveyor to agree valuations, new rates and the final account.

Some Building Definitions:

- ***Arris:*** The rounding of a sharp edge usually formed by any two surfaces meeting at an angle.
- ***Attic:*** Habitable room entirely within the roof space of a building.
- ***Balcony:*** Platform enclosed by a railing or balustrade, projecting from or recessed into the face of a wall of a building or structure.
- ***Capital:*** The head of a column or plaster immediately under a beam.
- ***De-watering:*** The removal of water from the ground by pumping out of a drowned caisson or foundation.
- ***In-situ:*** Latin for 'in place' referring to materials that are cast or assembled in their permanent position in a building or structure as distinct from being cast or assembled before installation.
- ***Jamb:*** A vertical side member of a door frame, door lining or window frame.
- ***Nib:*** a) A small projection in a wall, floor or other surface.
  b) A small projection on a casting for fixing purposes, as on a roof tile.
- ***Plinth:*** Slight widening or thickening projection at the bottom of a wall, pedestal or column.

1.6 Contract documents

The contract documents consists of the information required that will constitute a legal binding between the contractor and the client from the date of tender to the finalisation of the contract. The following documents, if agreed and signed by all the parties concerned, will be accepted to be contract documents.

1.6.1 Contract conditions

All the information in this document will be a layout of the terms and conditions under which the contract will be administered. This document is also applicable to the sub-contractors who perform their work under the supervision of the main-contractor.

1.6.2 Contract drawings

The contract drawings means the set of drawings that form a part of the legal contract for services between two or more parties. It typically includes a site plan, plans views, elevations, diagrams, details of several projections. These drawings must be signed and dated by both parties.

1.6.3 Specifications

Specifications must be read together with the drawings. It will fully describe the quality of the materials to be used on the project as well as clear description of the quality of the workmanship. If there is a conflict, the specifications on the drawings will take preference over the specifications or work schedules.

1.6.4 Bills of Quantities

This is the document compiled by the quantity surveyor. This document is a complete reproduction, word form, of the designer's ideas and specifications for the project and strictly in accordance with the rules as laid down in the Standard System of Measuring Builder's Work.

1.6.5 Schedule of rates

This is a document also compiled by the quantity surveyor in the event where time cannot be wasted to compile a bills of quantities. It will consist of all the trades and items that will be applicable, but without any quantities. The tenderers will be required to insert rates for these items for submission at tender date.

1.7 Preparation of valuations for payment certificates

Most standard forms of contract have a provision to pay the contractor on a stage payment, as the work proceeds. The stage payments or interim accounts are prepared usually on a monthly basis by the contractor's surveyor (building or contract surveyor) and the client's surveyor (professional quantity surveyor).

When preparing an interim valuation the following items may be included, if applicable:

- Preliminaries as per bills of quantities.
- Measured work as included in the bills of quantities.
- Value of variations and extra works.
- Work carried out by nominated sub-contractors and suppliers.
- Materials on site.
- Cost fluctuations (escalations).
- Approved loss and expense claims.

The following information will be collected:

- The quantity surveyor will visit the site to establish the % of builders work completed measured in the bills of quantities for each trade.
- The quantity surveyor will valuate all variation orders issued by the architect and include in the valuation.
- Cost of specialist materials delivered to site must be established and included in the valuation.
- Work done by nominated sub-contractors must be measured and included in the valuation.
- The cost of any materials on the site as well as materials stored off site, must be estimated and included in the valuation.
- The cost of work done as day works must be valued and included in the valuation.

- To establish the value of provisional quantities allowed in the bills of quantities, such work must be measured as the work proceeds on site.
- Cost fluctuations must be calculated for materials, labour and plant.
- An amount will be withheld and deposited in a retention fund.

The draft valuation will be scrutinized by the architect. If in agreement, the architect will issue a valuation certificate. The client will now be instructed to make the payment as certified to the contractor.

1.7.1 The retention fund

This is a fund established in the names of the contractor and the client with a reputable financial institution for the safekeeping of monies withheld from the contractor.

The maximum value of this fund may not exceed 5 % of the contract amount. It is common practice in the building industry to withhold every month 10 % of the interim payments until such time the fund reaches the required amount.

Retention is withheld for the purpose to repair any defects that might arise after the contractor has left the building site. It is expected from the contractor to return to the site to do these repairs.

In the event of the contractor not being available, the retention monies will be used to finance the work. All retention monies are included and paid to the contractor when the final account is agreed.

BILLS OF QUANTITIES SUMMARY		
Preliminaries	R	150 300,00
Earthworks	R	95 500,00
Concrete, Formwork & Reinforcement	R	475 750,00
Masonry	R	250 520,00
Waterproofing	R	27 000,00
Roof Covering	R	205 300,00
Carpentry & Joinery	R	75 350,00
Ceilings	R	25 750,00
Floor Coverings	R	45 500,00
Ironmongery	R	7 800,00
Metalwork	R	43 500,00
Plastering	R	35 650,00
Plumbing & Drainage (provisional)	R	55 700,00
Glazing	R	20 500,00
Painting	R	45 550,00
External Works	R	65 450,00
Provisional & Prime cost sums	R	125 300,00
Contingencies	R	55 000,00
	R	1 805 420,00

Table 1.1

Worked example 1

Consult the final summary of the bills of quantities shown in Table 1.1 and prepare the FIRST partial payment to the contractor based on the following information established on site.

- The contract period is 10 months
- All the earthwork is complete
- 20 % of the concrete work and 10 % of the masonry is complete
- A further R 6 400,00 for plumbing & drainage pipes is allowed
- The value of unfixed materials on site is 7 000,00
- Allow a 10 % deduction for the retention fund.
- All calculated amounts must be rounded off to the nearest TEN (10) rand.

Solution:

Preliminaries	1/10 of R 150 300,00	R 15 030,00
Earth Works	100 % of R 95 500,00	R 95 500,00
Concrete	20 % of R 475 750,00	R 95 150,00
Masonry	10 % of R 250 520,00	R 25 050,00
Plumbing		R 6 400,00
Builder's work complete		R 237 130,00
Add unfixed materials		R 7 000,00
Total value of 1st claim		R 244 130,00
Less 10 % for retention fund		R 24 410,00
Payment to contractor		R 219 720,00

Worked example 2

Consult the bills of quantities final summary shown in Table 1.1 and prepare the SECOND partial payment due to the contractor based on the following information collected on site:

- Earthwork is 100 % complete
- Concrete is 25 % complete
- Masonry is 40 % complete
- Plumbing is 20 % complete
- Value of the unfixed material is R 6 500,00
- The contractor was paid R 219 720,00 after retention was deducted.

Solution:

Preliminaries	2/10 of R 150 300,00	R 30 060,00
Earthwork	100 % of R 95 500,00	R 95 500,00
Concrete, Formwork & Reinforcement	100 % of R475 750,00	R 475 750,00
Masonry	40 % of R 250 520,00	R 100 210,00
Plumbing & drainage	20 % of R 55 700,00	R 11 140,00
Builder's work complete		R 712 660,00
Add unfixed materials		R 6 500,00
Total value of work done for 2nd month		R 719 160,00
Less 10 % for retention fund		R 71 920,00
		R 647 240,00
Less 1st month payment		R 219 720,00
2nd payment due to the contractor		R 427 520,00

1.8 Preparation of final accounts

The preparation of final accounts is the process whereby the contract price sum is adjusted to take into account all variations, savings, extra work which may have arisen during the course of a contract to reflect the final cost of the works.

Similarly to the preparation of the interim valuation, the final account is also drawn up in draft form and would include all known variations, together with the adjustment of prime costs and provisional sums allowed in the bills of quantities to show the final costs of the respective nominated suppliers and nominated sub-contractors accounts.

The final account is sent to the architect in draft form for his comments and confirmation. If any adjustments needs to be made, it will made prior to the final agreement with the contractor.

When preparing a final account, the following points must be borne in mind;

- The contingency sum must be deducted from the tender price to establish the original contract amount.
- Adjust all provisional prime cost and provisional sums also taking into account added profits and attendances allowed by the contractor.
- All provisional quantities allowed in the original bills of quantities must be omitted and replaced with the measured quantities as the work was executed on site.
- Check that adjustments are made due to errors in the original priced bills of quantities submitted by the contactor when tendering.
- Check that all savings or extra costs occasioned by the architect's instructions have been included in the final account.
- Check that costs fluctuations for materials, labour and plant is calculated and included in the final account.
- Check that calculated amounts are not rounded off as when the interim valuations are prepared. Every cent must be paid out to the contractor.

Worked example 3

Prepare the draft final account for this project using the information supplied below;

- Preliminaries to be adjusted to R 166 325,55;
- Earthworks to be adjusted to R 105 312,33;
- Masonry to be adjusted to R 240 675,99;
- Plumbing & Drainage to be adjusted to R 54 344,87;
- Provisional & Prime Cost sums to be adjusted to R 122 500,00;
- Cost increase amounted to R 75 820,66;
- Payments made to the contractor R 1655 370,00.

Solution overleaf ...

Solution:

Tender amount		R 1 805 420,00
Less contingency amount		R 55 000,00
Original contract amount		R 1 750 420,00
SAVINGS (To be deducted from the account)		
Masonry R 250 520,00 – R 240 675,99	= R 9 844,01	
Provisional & Prime Cost sums		
R 125 300,00 – R 122 500,00	= R 2 800,00	
Plumbing & Drainage		
R 55 700,00 – R 54 344,87	= R 1 355,13	R 13 999,14
		R 1 736 420,86
EXTRAS (To be included in the account)		
Preliminaries R 166 325,55 – R 150 300,00	= R 16 025,55	
Earthworks R 105 312,33 – R 95 000,00	= R 10,312,33	
Increased costs	= R 75 820,66	R 102 158,54
Recalculated contract amount		R 1 838 579,40
Less previous payments made to contractor		R 1 655 370,00
Full and final payment to contractor		R 183 209,40

Activity 1.1

1. What are the most important duties of a quantity surveyor?
2. What are the most important documents a quantity surveyor uses?
3. Describe their uses.
4. What steps should be followed when drafting
   a) interim valuations and
   b) final accounts?

Self Check

I am able to:	YES	NO
• Describe the most important duties of a quantity surveyor.	○	○
• Describe the most important documents a quantity surveyor would be dealing with as well as their uses.	○	○
• **Demonstrate the steps to be followed when drafting:**	○	○
o **interim valuations**	○	○
o **final accounts**	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Module 2 Foundations

Learning Outcomes

On the completion of this module the student must be able to:

- Demonstrate how to measure internal walls
- Describe how to clarify the measuring face brickwork

2.1 Introduction

This module will describe how to measure internal walls and how the measuring face brickwork should be clarified.

2.2 Measurements

Figure 2.1 is a sketch that shows all the work that needs to be on your check list when measuring the foundation section of dwelling;

- Arrow **A** shows the concrete surface bed. Bear in mind to include striking off and curing of the top surface.
- The damp proof sheeting is the darker shaded line between arrow **A** and **B**.
- Arrow **B** shows the hard core filling, consisting of a mixture of sand and rubble.
- Arrow **C** indicates the position of the risk of collapse, and the same will apply on the other side of the trench. The height would be the distance between the undersides of the concrete foundation and the hard core.

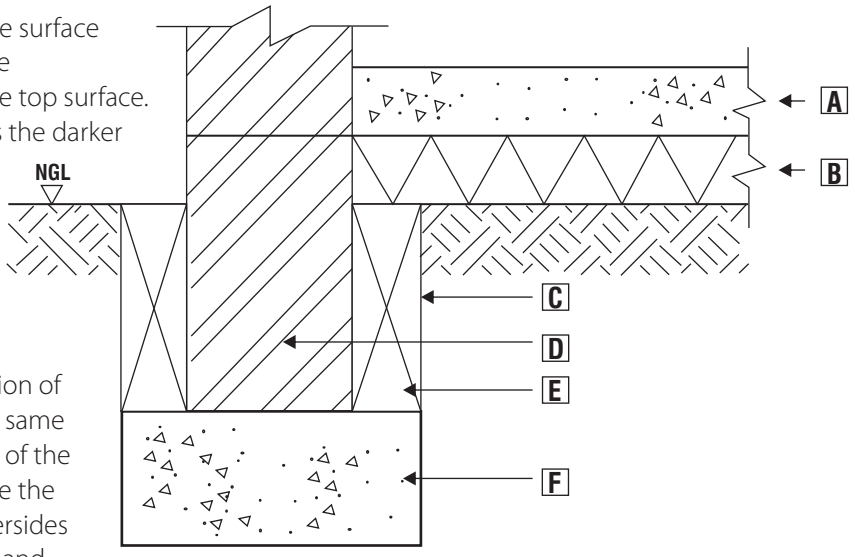
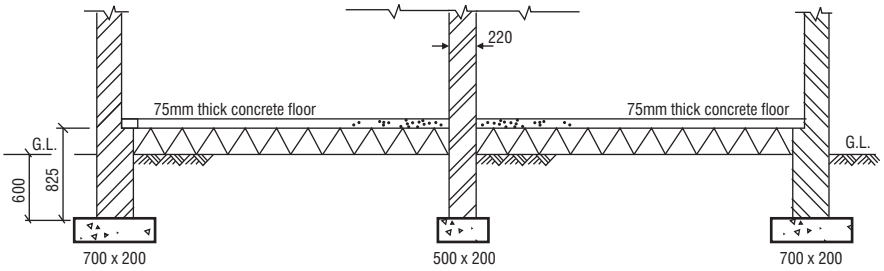


Figure 2.1

- Arrow **D** shows to the foundation brick wall.
- Arrow **E** shows to the areas where backfilling must be measured.
- Arrow **F** shows to concrete strip foundation.

On this level you will be required to measure foundations but the internal walls will be included. Study the drawings shown in **Figure 1.1**, together with the specifications for this dwelling shown in **Table 1.1**.



The notes will not make use of the complete dimension sheet, but will deal with each item separately.

2.2.1 Measuring or check list

- Site clearance (s.c.)
- Excavation (excav.)
- Risk of collapse (r.o.c.)
- Water (h_2o)
- Concrete in footings (conc.)
- Foundation walls (fdn. wls.)
- Backfilling (bflg.)
- Hard core (h.c.)
- Waterproofing (d.p.c.)
- Facings (fcgs.)
- Concrete surface bed (c.s.b.)

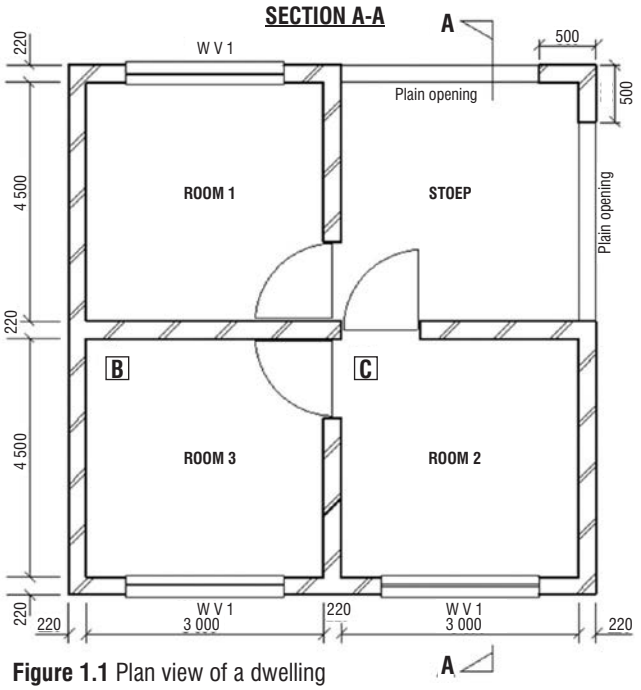


Figure 1.1 Plan view of a dwelling

The first item for this foundation is the cleaning of the building area. If no clearing distance from the building is provided, allow 3 meters all around the building.

In this case we are told to allow 1,5m. We now need to calculate the dimensions for this item. It is a rectangular building, thus two dimensions must be calculated.

Thus:

width =	2 x 3,000 =	6,000	**length** =	2 x 4,500 =	9,000
	3 x 0,220 =	0,660		3 x 0,220 =	0,660
		6,660 **(ext. width)**			9,660 **(ext. length)**
	2 x 1,500 =	3,000		2 x 1,500	3,000
		9,660 m			12,660 m

Note:
We measure over the openings for doors as well as plain openings.

	12,66 9,66		C.s. of all debris, veg. matter & Rubbish & prepare site for builders work.

Table 2.1 An example of the item for the site clearance

Note:
- Site clearance is measured in square meters, thus two dimensions are required. *
- The general site clearance item will include trees not exceeding 200mm girth.
- Draw a line below the two dimensions to indicate a square meter item.
- Do not forget to bracket the whole item including possible side casts.

*** Consult your Standard System, page 6, clause 4.**

The site is now clean and ready for the building to be set out. Allowance will be made in the preliminary and general section of the bills of quantities for setting out.

We will now measure all the other items in the earthwork trade, starting with excavation.

Let us first calculate the centre lines for the external and internal foundations.

Note:
Our drawing clearly indicates that the external 220mm thick walls are not built in the centre of the foundations, but rather the external 330mm thick foundation wall.
Therefore, if we have established the centre line of the 330mm thick external wall, we have also established the centre line of the external trench.

Let us now calculate the centre line of the external 330mm thick wall.

Thus:

2 x 6,660	=	13,320	this length is the total length around the outside of the building or we can also say the external perimeter of the building.
+ 2 x 9,660	=	19,320	
		32,640m	

The centre line would be 32,640m less 4 x 0,330 (4 corners) = 31,320m.

We now need to establish the centre line of the internal 220mm thick walls which is built in the centre of the 500mm wide foundation. The length 9,660m is the external length of the building. Therefore if we deduct 2 x 0,330m, the length of the 220mm wall along the length would be 9,000m.

The width would be 6,660 less two wall thickness of 0,330m = 6,000m less another 220mm where the walls cross, leaving us with a length of 5,780m.

Thus, the centre line of the internal 220mm thick walls is = 9,000 + 5,780 = 14,780m.

These centre lines can be used to measure the items for excavation, risk of collapse, backfilling as well as the 0,330 and 220mm thick walls later.

Note:
Now that we are dealing with internal walls, we have the problem of over measuring at all the intersections. The over-measured area at these intersections are called passings.

At this stage it is advisable to get used to one method. We can later look at another method to reduce the amount of passings.

2.3 Measurement of the excavations.

We know at this stage that excavations are measured in cubic meters.

Consult your Standard System, page 6, clause 6.

Thus we would need three dimensions.

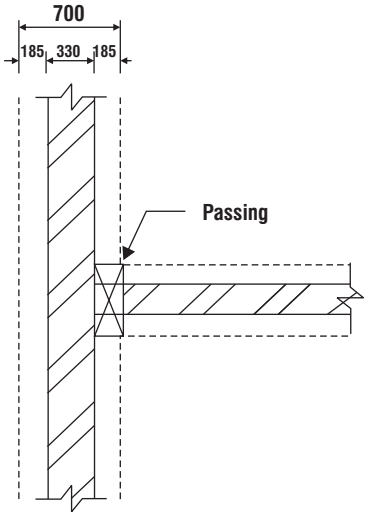
When two or more items are bracketed together, both or all share the same dimensions. The total volume of soil excavated will be transferred to the abstract sheet where the adjustment will be made for the volume of soil used for filling.

	31,32 0,70 0,80	Excav. in earth for surface trenches n.e. 2m deep from the ground level.
	14,78 0,50 0,80	*Ext. trench* *Int. trenches*
		Collections: Depth : 0,600 + 0,200 = 0,800m & Excav. mat. Available for filling & rem. to be carted away.

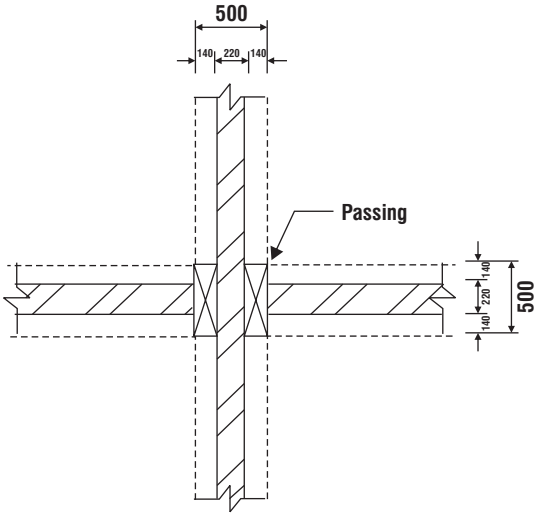
Table 2.2

The sketches in **Figure 2.2** show an example of where a passing has occurred. See areas crossed out. A passing only means that something has been measured more than once, and an adjustment will have to be made.

The drawing on the left shows a T-junction between the external 330mm wall and the internal 220mm wall. This occurs 4 times. The following drawing shows a cross intersection between the 220mm thick internal walls. A passing would occur twice directly opposite each other.



FOUNDATION T-JUNCTION (B)



FOUNDATION CROSS-JUNCTION (C)

Figure 2.2

The intersection above has occurred 4 times. See if you can spot them on the plan view. Table 2.3 shows how the over measurement is taken care of. These items are all DEDUCT items.

		Ddt.
4	0,50 0,19 0,80	Excav. forsurface trenches as before.
		Intersections with ext.trench
2	0,50 0,14 0,80	*Intersections at 220mm wall crossing*
		Collections: Width of backfill: at 330mm wall = 185mm at 220mm wall = 140mm & Ddt.
		Excav. mat. for filling as before.

Table 2.3

The next item to be measured is risk of collapse. If you consult the Standard System, risk of collapse is measured in SQUARE METERS.

Consult your Standard System page 7,clause 10.

Take special care of the category, which is either not exceeding 1,5m or exceeding 1,5m when the excavation depth is deeper than 1,5m. Two dimensions are required, namely the length and the depth of the excavations. See **Table 2.4**;

2	31,32 0,80		R.o.c. to sides of surface trenches n.e. 1,5m deep from the g.l.
2	14,78 0,80		*Ext. r.o.c.*
			Int. r.o.c.

Table 2.4

We have an over measurement for risk of collapse at the six intersections. Let's do the adjustment for that now.

Our next item to measure would be water. The cost to keep excavation dry could vary from none, to a small expenditure, depending on the water level for surface trenches, to very high expenditure when more sophisticated methods are required when excavations for a basement needs to be done.

Measurements for water are impossible to establish. The Standard System therefore requires that an estimate for water expenses be allowed when tendering.

			Ddt.
4	0,50 0,80		R.o.c. as before. *Ext. intersection*
2	0.19 0,80		*Ext. intersection*
2	0,50 0,80		Int. intersection
2	0,14 0,80		

Table 2.5

Consult your Standard System, page 7, clause 13.

Water is thus measured as an ITEM in the bills of quantities. Table 2.6 shows an example for the measurement of water.

	Item		Allow to keep excav. dry.

Table 2.6

The measurement of concrete in the foundation footing will be no different from the measurement of the excavations. The only difference would be the height of the concrete footing. Concrete is measured in CUBIC METRES.

Consult your Standard System, page 13, clause 2.

	31,32 0,70 0,20		15 Mpa. Mass conc. in strip foundations. *Ext. footing*
	14,78 0,50 0,20		*Int. footings*

Table 2.7

If there were passings for excavations, there would also be passings for the footings. We thus need to do an adjustment. See **Table 2.8**.

4	0,50 0,19 0,20		Ddt. 15 Mpa. Mass conc. in strip foundation as before.
2	0,50 0,14 0,20		*Ext. intersections* *Int. intersections*

Table 2.8

The next item on our measuring list is the brickwork in the foundations. You will notice that brickwork is measured under the trade name of MASONRY.

All brickwork is measured in SQUARE METRES, except when piers or mass brickwork is measured.

Consult your Standard System, page 18, clause 6.

We will measure the brickwork using ordinary or plaster bricks. An allowance needs to be made for the face brickwork on the outside later.

Note:
The item needs to include the wall thickness, type of bricks, the mortar mixture, where the wall is built, as well as the bond it is must be built in.

The standard system is very clear that different wall thicknesses must be measured separately. The next item will then be for the 220mm thick foundation wall.

	31,32 0,83		330mm Thick foundation wall in ord. bks. in 1:4c.m. mix blt. In stretcher bond.

Table 2.9

You will notice that no collections for the wall height need to be made, as it is provided on the drawing. There are also no passings because we are using the centre line dimension of the walls.

	14,78 0,83		220mm Thck. fdn. bkwl. in ord bks. in 1:4c.m. blt in s.b.

Table 2.10

The next item to be measured is the backfilling.

Consult your Standard System, page 8, clause 14, (the last paragraph).

You will see that backfilling is also measured in CUBIC METRES, therefore we need three dimensions.

On the drawing you will notice the height of the backfilling to be 600mm. The width has been calculated previously.

2	31,32 0,19		Backfilling to the sides of the foundation walls.
2	0,60 14,78 0,14 0,60		

Table 2.11

Note:
The dimensions are multiplied by two, because we are backfilling on both sides of the walls. Also note that passings does occur, so an adjustment needs to be made.

All the passings in the foundation are now taken care of. To reduce the amount of passings we will have to establish the centreline length of the trenches.

The centre line length of the external trench would in our case remain the same, thus 31,320m.

			Ddt.
4	0,50		Backfilling to sides of fdn. walls as before
	0,19		
	0,60		
2	0,50		*Ext. intersections*
	0,14		
	0,60		*Int. intersections*

Table 2.12

A new length, however for the internal trenches will have to be established as follows;

The length of 14,780m will be shortened by 4 x 0,185 at the external wall intersections and therefore: 14,780 – (4 x 0,185 + 2 x 0,140) = 13,760m.

If the trench centre line were to be used, we will have no passings for the excavation and concrete footing items. However, we would still have to do the following adjustments for the risk of collapse and backfilling items.

2.			Ddt.
4	0,50		R.o.c. to the sides of s.t. as before.
	0,80		4 ext. added 2 int.
			Ddt.
2	0,22		Backfilling to sides of fdn. wls.
	0,19		
	0,60		*4 ext.*
2	0,22		
	0,19		
	0,60		*2 int.*

Table 2.13

The next item to be measured is for hardcore. The hardcore is between the 330 mm thick walls. Hardcore is measured in CUBIC METRES.

Consult your Standard System, page 8, clause 14.

The length and width between the external 330 mm thick walls are ;
9,660 – 2 x 0,330 = 9,000m and
6,660 – 2 x 0,330 = 6,000m

			If we use the first dimension
	9,00		Hardcore filling under conc. surface bed.
	6,00		
	0,23		

Table 2.14

You will notice that we have also included the internal walls, for which we will have to make an adjustment as follows;

			Ddt.
	14,78		H.c. filling a.b.
	0,22		
	0,23		

Table 2.15

Consult your Standard System, , page 25, clause 1.

Damp proof sheeting is measured to the external dimensions and is measured in SQUARE METRES.

	9,66 6,66		Damp proof sheeting under conc. surface bed.

Table 2.16

The measurements for the concrete surface bed is given on the drawing, between the 220mm superstructure walls.

4	4,50 3,00 0,08		15 Mpa mass conc. in s.b. incl. striking off & cure the horizontal top surface.

Table 2.17

The last item on our measuring list is face brickwork.

Consult your Standard System, page 20, clause 25. You will notice that the Standard System requires you to measure an 'EXTRA OVER' item.

This simply means that because the 330mm foundation brick wall is being measured already, you need to measure an additional item that will cover the difference in cost for labour and material to change the external face to face brickwork.

	32,64 0,38		Extra over ord. brkwrk. For facings. Collections: Height 0825 – 0,600 = 0,225 (two courses below g.l.) 0,225 + 0,150 0,375 m

Table 2.18

To do this we need the external perimeter dimension, which is 26,640m, previously calculated.

Activity 2.1

1. Describe how to measure internal walls correctly.
2. Explain how to clarify the measuring face brickwork.

Self Check

I am able to:

	YES	NO
• Demonstrate how to measure internal walls	○	○
• Describe how to clarify the measuring face brickwork	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Notes

Module 3 Basements

Learning Outcomes

On the completion of this module the student must be able to:

- Demonstrate how to take care of the different categories when measuring deeper than 2 meters into the earth.
- Demonstrate how the creation of working space is measured.

3.1 Introduction

When measuring basements it is important to note the different categories when measuring deeper than two metres into the earth. It is very important to measure correctly when creating working space.

3.2 Working with basements

When measuring a basement, the excavation of the basement hole needs special attention. When excavating deeper than 2m into the earth, additional items are to be measured for each successive depth of 2m.

Consult your Standard System, page 6, clause 6.

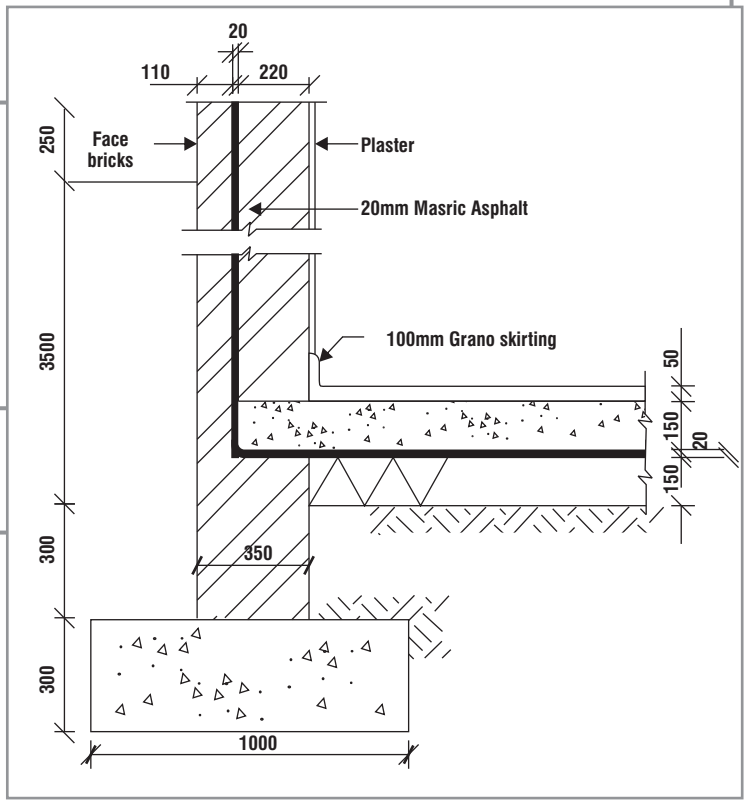
The category for the item for risk of collapse will also change to deeper than 1,5m.

The danger of the excavation walls collapsing is obvious. To ensure the safety of the workers and to allow extra space, an item for working space must be measured.

Consult your Standard System, page 7, clause 11.

The other trades that need to be measured were dealt with in N4.

A sectional view of a basement is shown. The external dimensions of the basement is 6,5 m long and 4,5 m wide.



3.3 Specifications

Earthwork

- The site is to be cleaned to an area 2 meters from the basement wall.
- Excavation is in ordinary earth.
- Excavated soil can be used for filling.
- Excess soil must be carted away to a dumping site approximately 10 kilometers from the building site.
- Allow 1m "working space" horizontally from the external half-brick skin wall.

Concrete

- 25 Mpa.

Brickwork

- Local stock bricks.
- 1:4 Cement mortar.
- Face bricks externally.

Before measuring any building, it is important that we study the drawings available, together with the specifications given. The next step would be to make a list of all the items to be measured to build this building, starting from the ground level, then excavations into the ground from where we then proceed back to the ground level.

The work above the ground level will then follow. It is important that we measure systematically.

We will now draw up the measuring list to measure this basement:

- Site clearance (S.c.)
- 220mm wl.
- R.o.c.
- Int. plast.
- Conc. footing
- Backfilling
- Vert. mastic asphal
- Conc. flr.
- Basement trench
- Grano. Skrtg.
- Water
- 350 mm wl.
- H.c.
- Mastic asphalt fillet
- Bulk excavations
- Grano. screed
- Working space (w.s.)
- Ext. facings
- 110 mm wl.
- Hor. mastic asphalt
- Conc. flr.

Definition: Fillet

Small angle moulding or strip formed in wood, stone, concrete, plaster and tanking.

The next step before we start measuring, a good practice would be to do some waste calculations in order to minimize the calculations during the taking off exercise.

For our purpose, we will do a waste calculation for each item, if required, followed by the measurement of the item.

For site clearance we need a length and a width of the area;

Thus:	Length	Width
	6,500	4,500
+ 2 x 2,000 =	4,000	4,000
	10,500 m	8,500 m

	10.50 8.50		C.s. of all debre, veg. matter & rubbish & prep. Site for bldr'swrk.

Table 3.1

As discussed previously, the setting out of the building is taken care of in the preliminary & general section of the bills of quantities.

We will now measure the bulk excavations for the basement hole:

Thus:

We need the external backfilling width, which is;

1,000 – 0,350 = 0,650 ÷ 2 = 0,325m

Hole length = 6,500 + 2 (0,325) = 7,150m

Hole width = 4,500 + 2(0,325) = 5,150m

As discussed previously, the categories for excavations deeper than 2m need to be taken care of. Therefore for a depth of 3m to the bottom of the hard core, we will have two categories, not exceeding 2m and exceeding 2m not exceeding 4m.

Now that we have measured the hole, we can now proceed to measure the basement trench.

We now need to calculate the centre line of the trench.

2 x 7,150 = 14,300
2 x 5,150 = 10,300
24,600 m = perimeter of the basement hole
-4 x 1,000 = 4,000
20,600 m

	7,15 5,15 2,00		Bulk excav. in ord. earth for basement hole n.e. 2m deep from the g.l.
	7,15 5,15 1,50		Ditto, but exce. 2m n.e. 4m dp. from the g.l. Depth for this category: 3,500 – 2,000 = 1,500m Note: All the soil excavated is available for filling.
	7,15 5,15 3,50		Excav. soil avail. for filling and rem. to be carted away.

Table 3.2

	20,60 1,00 0,60		Excav. in ord. earth for basement trench n.e. 2m dp. from the basement flr. level. Depth: 2 x 0,300 = 0,600 m & Excav. soil avail. For filling.

Table 3.3

The next item to be measured is for risk of collapse. You will notice that there are risk collapse to protect the walls of the hole as well as the internal side of the trench.

	24,60 4,10		R.o.c. to the sides of the basement hole exce. 1,5m dp. from the g.l. External depth = 3,500 + 0,600 4,100 m
	16,60 0,60		Ditto, but n.e. 1,5m from the basement flr. level. Internal perimeter of trench: 24,600 -8 x 1,000 8,000 16,600 m

Table 3.4

The next item we need to measure is to create space for the workers inside the hole that will be excavated.
To measure the working space, the Standard System requires following information in the description.

	22,00 0,50		Excav. for w.s. approx. 1m hor. from The basement wl. n.e. 500mm dp. from the g.l. incl. backfilling & comp. of excav. material. Ext. perimeter of the basement wall: 2 x 6,500 = 13,000 2 x 4,500 = 9,000 22,00 m

Table 3.5

The content of the description does not replace the items measured in clause 6 of the earthwork trade.

- The horizontal distance and from where.
- The category of each item.
- The backfilling of the soil removed.

	22,00 1,00		Ditto, but exce. 500mm n.e. 1,5m dp. ditto. Depth = 1,500 – 0,500 = 1,000m
	22,00 1,50		Ditto, but exce. 1,5m n.e. 3m dp. ditto. Depth = 3,000 – 1,500 = 1,500 m
	22,00 0,50		Ditto, but exce. 3 m n.e. 4,5 m Depth = 3,500 – 3,000 = 0,500 m

Table 3.6

Note:
Working space is measured in SQUARE METRES.

The next item is water which you should be able to do at this stage. So let's proceed to measure the concrete in the basement foundation.

	20,60 1,00 0,35		25 Mpa. Mass conc. in basement ftg. Note: The width and the thickness of the footing is given on the drawing

Table 3.7

Let us proceed to measure the 350mm and 110mm thick walls. Keep in mind the information that must be provided in the descriptions when brick walls are measured.

You would have noticed that it was not necessary to calculate centre line of the 350mm wall because we already had the information when the centre line of the trench was calculated. But we will have to calculate the centre line of the 110mm wall.

	20,60 0,45		350 mm Thick basement wl. In ord. bks. in 1:4 c.m. blt. In stretcher bond. Height= 0,300 + 0,150 = 0,450m

Table 3.8

The external perimeter of the basement wall is 22m.

Thus: 22,000 – 4 x 0,110 = 21,560m

	21,56 3,30		110 mm Basement skin wl. In ord. bks. in 1:4 c.m. mix blt. In stretcher Bond. Height of wall = 3,500 – 0,450 = 3,050 + 0,250 3,300 m

Table 3.9

From our drawing you will see that backfilling must be measured next to the 110mm brick wall As well as on the internal side of the 350mm brick wall. We cannot use the centre line of the Trench because the heights are not the same. Thus we need to calculate the centre lines of both.

Centre line of the ext. backfilling
= 22,000 + 4 x 0,325 = 23,300m

Centre line of the int. backfilling
= 16,600 – 4 x 0,325 = 15,300m

	23,30 0,33 3,80 15,30 0,33 0,30		Backfilling to sides of basement wls. Height of ext. backfill = 3,500 + 0,300 -ext. = 3,800 m -int.

Table 3.10

The next item to measure is the hard core filling. To measure it, we need the length and width of the area on the inside of the 350mm thick basement wall.

	5,80 3,80 0,15		H.c. filling under basement conc. slab.

Table 3.11

Thus:
The length would be 6,500 – 2 x 0,350 = 5,800m

The width would be 4,500 – 2 x 0,350 = 3,800m

The basement must be completely waterproofed. Waterproofing is measured in SQUARE METRES.

Consult your Standard System, page 25, clause 2.

The type of waterproofing membrane requires that the manufacturer's instructions be strictly followed.

The labour intensity is different between the vertical and horizontal applications, therefore it would be advisable to keep them separate. The intersection between them must be properly sealed and requires extra labour and material to form a fillet.

We now need to calculate the horizontal length and width.

Thus: 6,500 – 2 x 0,110 = 6,280m
4,500 – 2 x 0,110 = 4,280m

	6,28 4,28		20mm Thick mastic asphalt to hor. surface of basement.
	21,04 3,30		Ditto, but to vert. brk. Surface. Centre line of vert. membrane: 2 x 6,280 = 12,560 2 x 4,280 = 8,560 21,120 Less 4 x 20 0,080 21,040 m The height = half brick wall =3,300m
	21.12		Extra for forming fillet @ intersection between vert. & hor. membranes.

Table 3.12

We have the dimensions of the concrete floor, so we can proceed to measure this item. When concrete floors or slabs are measured, we must not forget that labour will be used to strike off (level off) the top surface as well as to keep the concrete wet, as specified, to allow for the chemical reaction in the mixture. This information must be included in the description.

	6,28 4,28 0,15		25 Mpa mass conc in basement flr. Incl. striking off & cure hor. top surf.

Table 3.13

To measure the 220mm thick wall we will need the centre line as well as the height of the wall.

The centre line = 2 x 5,800 + 2 x 3,800 = 18,760
+ 4 x 0,220 0,880
19,640m

The height is = 3,300 – (250 + 20) = 3,030m

All that is left to measure now is the internal finishes. Let us measure the granolithic floor screed.

	19,64 3,03		220mm Thick basement wl. In ord. bks. in 1:4 c.m. mix blt in stretcher bond.

Table 3.14

Consult your Standard System, page 42,clause 1.

This concludes the measurement of all the work for this basement.

	5,80 3,80		50mm Thick grano. screed to bsmnt. conc. flr.
2	5,80		100mm Grano. Skrtg.
2	3,80		
	21,12 2,83		19mm Thick int. pls. to vert. bk. wls. In bsmnt.
			Height = 3,030 – (150 +50) = 3,830m

Table 3.15

This concludes the measurement of all the work for this basement.

Activity 3.1

1. How are the different categories taken care of when measuring deeper than 2 metres into the earth?
2. How is the creation of working space measured?

Self Check

I am able to:

	YES	NO
• Demonstrate how to take care of the different categories when measuring deeper than 2 meters into the earth.	○	○
• Demonstrate how the creation of working space is measured.	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Notes

Module 4 Fence Walls

Learning Outcomes

On the completion of this module the student must be able to:

- Explain why screen walls are basically the implementation of the measurement of all the trades already dealt with previously.
- Be confident in measuring any fence wall.

4.1 Introduction

Fence walls are built on the boundaries of properties. To build such walls, a plan would be required for submission to the local municipality for scrutiny and approval. Fence walls are built on a strip foundation if materials such as bricks or blocks are used.

Piers are normally used to break not only the monotony of a continuous wall, but also to strengthen the wall. The top of the wall is normally decorated with a coping on the wall and a pier cap on the piers. The requirements for a precast slab wall would be different and the measurement of such walls will not be dealt with in this course.

The drawing herewith shows the plan, sectional and front views of a typical fence, garden or boundary wall.

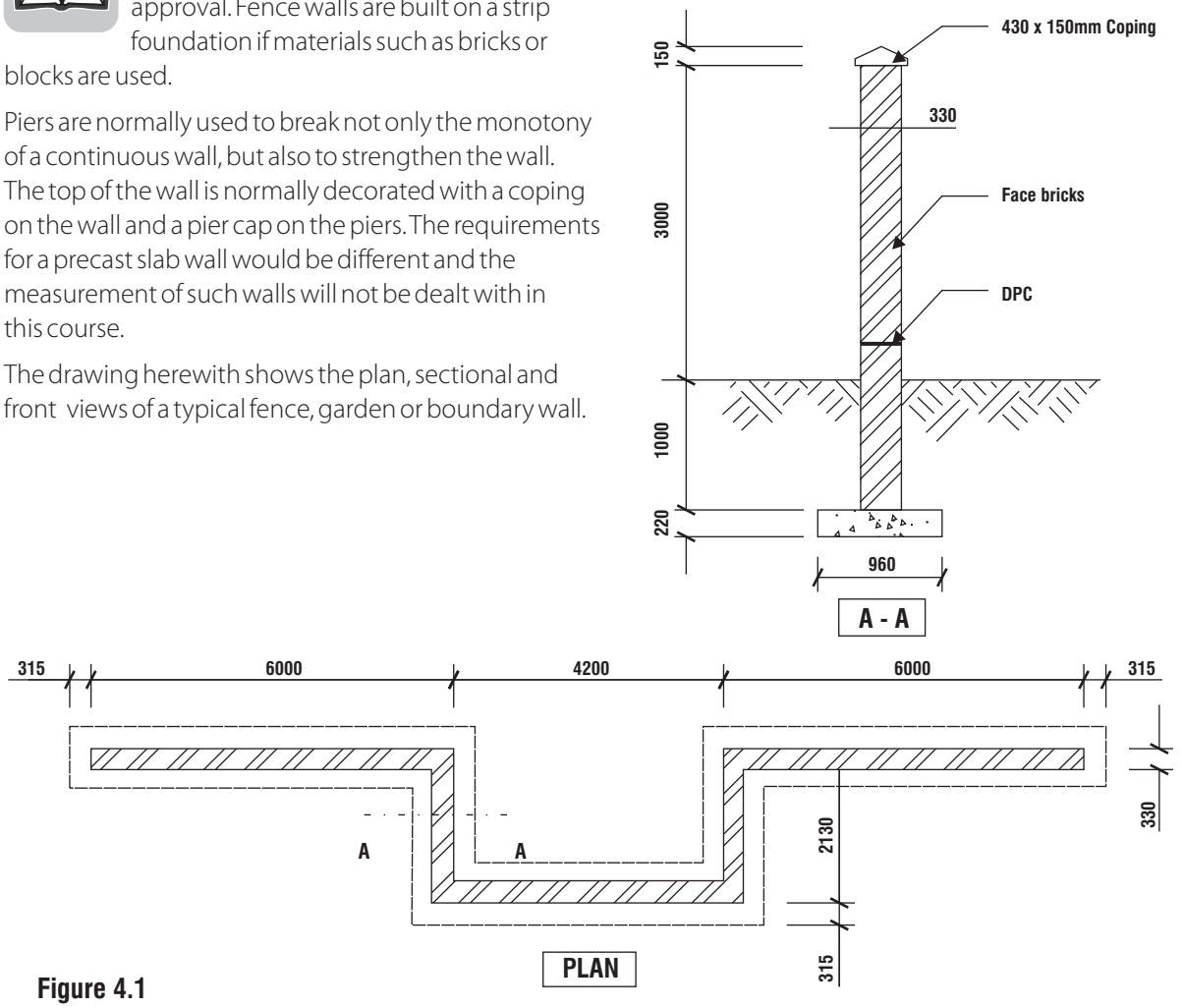


Figure 4.1

Note:
The wall will be measured from the top of footing to the underside of the precast concrete coping. The opening for the door will not be considered.

4.2 Specifications

Earthwork:

- The site is clean and ready for builder's work
- Excavation in ordinary earth.

Brickwork:

- Ordinary plaster bricks.
- 1:4 Mortar mix.

Concrete:

- 15 Mpa.

Painting:

- One coat plaster filler coat and two coats P.V.A. paint.

Let us now draw up a list of all the work to be done to build this wall;

- Excav.
- Bkfll.
- Conc. ftg.
- Pt.
- D.p.c.
- Water
- Plast.
- R.o.c.
- P.c. conc. coping
- 330 mm bk. wl.

The first item to be measured is the excavation of the trench.

On the plan view of your drawing the backfilling width is given. Let us calculate the length of the wall first, then we only need to add twice the backfilling width at both ends.

Thus:

6,000 + 4,200 + 6,000 + 2 (2,130) = 20,460 m – This is the length of the wall.
+ 2 x 0,315 0,630
21,090m – This is the length of the trench

	21,09 0,96 1,22		Excav. in ord. earth for s.t.n.e. 2m Dp. from the g.l. Collections Depth = 1,000 + 0,220 = 1,220 m

Table 4.1

We will now measure the risk of collapse and water. The dimensions for the risk of collapse are available, so lets proceed with the taking off.

2	21,09 1,22		R.o.c. to sides of s.t.n.e. 1,5 m dp. from the g.l.
2	0,96 1,22		
	Item		Keep excav. free of water

Table 4.2

We will now measure all the items left on our list. We will need the heights of the wall and the plaster. Remember we need to add at least two layers of brickwork to be plastered below the ground level.

For teaching purposes we would allow 75mm for one course thickness, although the correct layer thickness should be 75 + 10 mm = 85mm.

Height of the wall: 3,000 + 1,000 = 4,000 m
Height of the plaster = 3,000 + 2(75) = 3,150 m

20,46 4,00	330 mm Thck. Bk. wl. In ord. bks. in 1:4 c.m. mix blt. In st.bnd.	
20,46 0,33	D.p.c. layer	
2 / 21,09 0,32 1,00	Bckfll. to sides of bk. wl.	
2 / 0,33 0,32 1,00	Wall ends	
2 / 20,46 0,32 1,00	**OR**	
2 / 0,96 0,32 1,00	Trench ends	
20,46	430 x 150mm P.c. conc. coping.	
2 / 20,46 3,15	19mm Thk. plas. to ext. vert. bk. wl.	
0,33 2 / 3,15	Wall ends & 1Ct. plast. Filler & 2cts. p.v.a. pt. to vert. plast. wl.	
20,46 0,87	1Ct. plast. Filler ct. & 2cts. P.v.a. pt. to p.c. conc. surfaces exce. 300mm girth Collections: 450 – 330 =120 ÷ 2 = 60 0,450 +2x150 0,300 +2x60 0,120 0,870m	

Table 4.3

Note:
The wall is 330mm wide which means that the plastering to the wall ends is on a surface wider than 300mm.

If you consult your Standard System, page 42, clause 3, you will see that if the width of the wall was smaller than 300 mm, the plaster to the edge should have been measured as plaster in narrow widths, not exceeding 300 mm wide, but still measured in SQUARE METRES. Also consult the painting trade in your Standard System, page 57, clause 3.

In the case of the edges being narrower than 300mm and a different colour, it must be measured as narrow widths not exceeding 300mm wide and measured in METRES. If there is no difference in the colour it must be included with the flat area which is measured in SQUARE METRES.

4.3 Measuring fence walls with attached brick piers:

There are three important points that need to be taken into account when brick piers are measured:

Consult your Standard System, page 18, clause 5.

1. Standard system on page 18, clause 5:
   1.1 Brick piers are measured in CUBIC METRES,
   1.2 Irregular shapes shall be measured separately.

2. If the pier is not attached to the wall, it will be called an isolated pier and measured as such. If the pier is built attached to the wall, it must be measured as an attached pier and measured as such. It might require more time to build a combination of wall and the pier together.

3. It would be easier to keep the measurement of all the work to the strip footing separate from the pier bases.

Activity 4.1

1. Why are screen walls the implementation of the measurement of all the trades previously dealt with?

2. Why should you be confident when measuring any fence wall?

Self Check

I am able to:

	YES	NO
• Explain why screen walls are basically the implementation of the measurement of all the trades already dealt with previously.	○	○
• Explain why will I be confident in measuring any fence wall.	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Module 5

Reinforced Concrete Structures

Learning Outcomes

On the completion of this module the student must be able to:

- Demonstrate the measurement of concrete in bases, columns, slabs and beams.
- Demonstrate measurement of formwork to the bases, columns and beams.
- Demonstrate the measurement of PROVISIONAL SUMS, (reinforcement in this case.)

5.1 Introduction

Reinforced concrete structures consist of columns, beams and slabs constructed with a concrete mixture and strengthened with reinforcing steel bars. Any concrete structure must be designed by a registered civil engineer. The engineer must calculate the strength or aggregate mixture of the concrete.

Concrete cube samples must be cast with each concrete cast for testing purposes. The number and diameter of each steel bar, the shape and length must be carefully calculated and designed for each element of the structure.

Definition: Secondary beam

A beam that transfers its load to the main or primary beam.

Such information is neatly presented on a bending schedule drawn up by the engineer. It is the quantity surveyor's responsibility to include the reinforcement in the bills of quantities to be priced by the tenderer or if the information is not available, the approximate value for the reinforcement can be included in the form of a provisional sum.

All provisional amounts will be adjusted at the end of the contract in the final account.

The drawing on the following page shows the plan view and the vertical section A-A through the concrete structure. The plan view shows a 300mm wide ring beam cast on top of two L-shape, two square and two circular columns. A 300mm wide internal beam is cast between the two circular columns.

On the diagonal line, the slab thickness is indicated. Section A-A shows the beam heights, which include the slab thickness. The columns will be measured from the top of the concrete base to the underside of the beams. Study the drawing for further details before continuing with the measuring of the concrete structure.

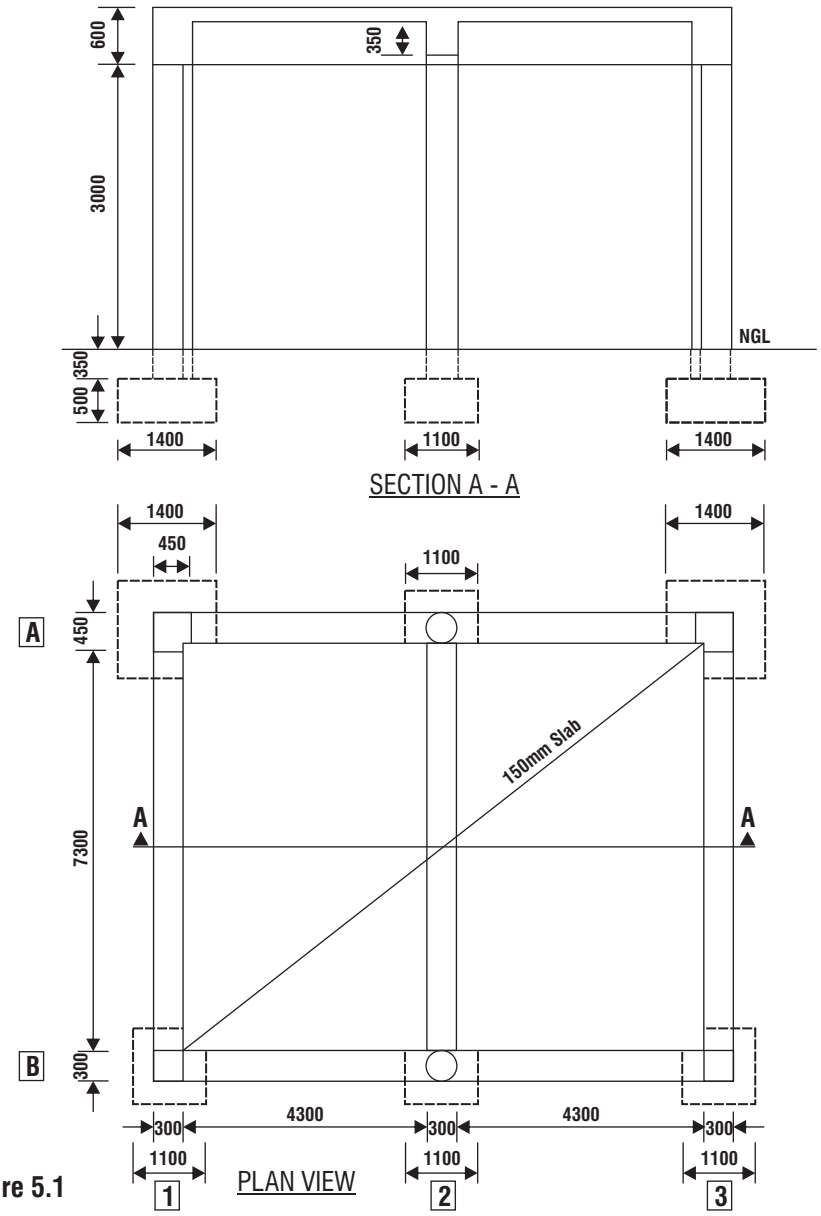


Figure 5.1

Note:
To maintain our systematic method of measuring, we will again start with the clearing of the site, followed by the bases, then the columns and then the beams and slab. The information of the steel rod reinforcement is not available, thus a provisional amount will have to be measured.

5.2 Specifications

Earthworks:

- Excavation in firm ground.
- Clear the site 3 metres around the structure from the concrete columns.
- Use material from excavations for filling.
- Allow working space of 300 mm in bases.

Concrete Formwork & Reinforcement:

- 30 Mpa concrete in bases and columns.
- 25 Mpa concrete in beams and slab.
- Formwork around the columns bases.
- Allow the provisional of R 25 000,00 for steel rod reinforcement.

Measuring list:

- C.s.
- Conc. Bases
- H_20
- Bms.&slabFrmwrk.
- Frmwrk. In bases
- R.o.c.
- Conc, in cols.
- Prov. Sum.
- Excav. Bases
- Col. frmwrk.
- W.s.
- Conc. in bms. & slab

Let us do the waste calculations for the site clearance:

	Length
2 x 4,300 + 3 x 0,300 =	9,500
2 x 3,000	6,000
	15,500m

	Width
7,300 +0,300 + 0,450 =	8,050
	6,000
	14,050m

	15,50 14,05		C.s. of all deb. veg. matter & rub. & prep. site for bldr'swrk..

Table 5.1

Depth of the excavations of the bases: 0,350 + 0,500 = 0,850 m

Girths of square bases for risk of collapse and working space;
4 x 1,400 = 5,600 m (A1 & A3)
4 x 1,100 = 4,400 m (A2, B1,B2,B3)

2 4	1,40 1,40 0,85 1,10 1,10 0,85	Excav. in firm grnd.for pier Bases. A1,A3 A2, B1, B2, B3	
2 4	5,60 0,85 4,40 0,85	R.o c. to sides of col. Bases n.e. 1,5m from g.l. A1, A3 A2, B1, B2, B3	
	Item	Keep excav. free of water.	
2 4	5,60 0,50 4,40 0,50	Excav. 300mm back hor. from sides of col. bases for w.s. n.e. 500mm dp. for placing & removal of frmwrk.	
2 4	5,60 0,35 4,40 0,35	Ditto, but exce. 500mm n.e. 1,5m Depth 0,850 – 0,50 = 0,35 m	

Table 5.2

The information to measure the steel rod reinforcement is not available, but a provisional amount for the sum of R 25 000,00 must be provided. Below the method to measure a provisional sum will be shown.

Note:

The following information must be provided;

- The type of specialist work to be done.
- The monetary value must be stated.
- The monetary value must be written out in word form.
- Additional items must be included to allow the main-contractor to add for profit on the nominated sub-contractor's work as well as for attendance upon the sub-contractor.

	Item		Allow the prov. amount of R 25 000,00 (Twenty Five Thousand Rand) for steel rod reinf. supplied, cut, bent, del. to site and placed in position. & Add …….% for profit if desired. & Add ……% for attendance upon nom. Sub-contractor.

Table 5.3

The provisional items were written up in 'taking off' form above. The same items will now be written up in bill form below.

1	Allow the provisional amount of R 25 000,00 (Twenty Five Thousand Rand) for steel rod reinforcement, supplied, cut, bent, delivered to site and placed In position.	Item	25 000,00
2	Add ……..% for profit if desired.	Item	
3	Add ……..% for attendance upon nominated sub-contractor.	Item	

Table 5.4

We will now measure the formwork around the concrete bases as well as the concrete in the bases. All the information is available, so let us measure the items mentioned.

2 / 4	1,40		Frmwrk. around conc. bases.
4	0,50		A1,A3
4	1,10		
	0,50		A2,B1,B2,B3
2	1,40		
	1,40		30Mpareinf. in bases.
	0,50		
			A1,A3
4	1,10		
	1,10		A2,B1,B2,B3
	0,50		

Table 5.5

We will now measure the formwork around the columns as well as the concrete in the columns.

To measure the formwork, you need to consult your Standard System, page 14, clause 14.

When a column is shaped differently from a square or rectangle, it must be kept separate. The reason being that the setting up of an L-shape, round or a column with more than four sides would be more difficult.

Note:
Formwork to columns is measured in SQUARE METRES, but a round column in METRES stating the diameter of the column.

2		
4	0,30	Frmwrk. to sides of cols.
	3,35	
		B1,B3
		Height =
2		3,000 + 0,350 = 3,350m
4	0,45	
	3,35	Ditto, but to L-shape cols.
		A1,A3
		Ditto, but for round cols.
	2	300mm dia.& 3,350 m high.
		A1,B2

Table 5.6

2	0,60	30Mpareinf. conc. in cols.
	0,30	
	3,35	A1,A3
2	0,30	
2	0,30	Collections:
0,25	3,35	Centre line of L-shape cols.
		B1,B3
Π	0,30	
	0,30	2 x 0,450 = 0,900 – 0,300
	3,35	= 0,600m
		A2,B2

Table 5.7

Note:
Formula to calculate a circle: $A = \Pi R^2$ or $\frac{\Pi D^2}{4}$. The latter was used.

We will now measure the items of the formwork to the slab and the beams. The dimensions for the decking under the slab is given on the drawing.

Consult your Standard System, page 14, clause 13.

The requirement that propping for heights must be indicated. The clause under the heading for slab thicknesses must also be taken into account.

2		
	4,30	Frmwrk. to soffits of slabs exce. 1,5m n.e. 3,5m high.
	7,45	
		7,300+ (0,450 – 0,300)= 7,450m
	33,90	Ditto, but to soffits of bms. exce. 1,5m n.e. 3,5m high.
	0,30	
		Ring beam
	7,45	
	0,30	
		Internal beam
		Centre line of ring beam: 2 x 9,500 = 19,000
		2 x 8,050 = 16,100
		35,100
		- 4 x 0,300 = 1,200
		33,900 m

Table 5.8

Consult your Standard System, page 14, clause 12.

Definition: Soffit

The lower surface or under of anything such as beams, slabs or roof ceiling.

We are therefore allowed to measure across where beams intersect for the sides of beams, as well as in the case of the soffits of beams where it runs over the tops of the columns.

The measuring of the concrete to the slab and the beams would be the last item for the measurement of this concrete structure.

2 /	35,10 0,15		Frmwrk to the sides of the bms.
	33,90 0,45		*Slab*
2 /	7,45 0,35		*Ring beam*
			Internal beam
			Ring beam height less the slab thickness 600 – 150 = 450mm

Table 5.9

	9,50 8,05 0,15		25 Mpareinf. conc. in slab incl. striking off & cure hor. top surface.
	33,90 0,30 0,45		Ditto, but in bms. *Ring beam*
	7,45 0,30 0,35		
			Internal beam

Table 5.10

Activity 5.1

1. How is concrete measured in a) bases, b) columns c) slabs and d) beam?
2. How is formwork measured in a) bases, b) columns and c) beams?
3. How are provisional sums (reinforcement), measured?

Self Check

I am able to:

	YES	NO
• Demonstrate the measurement of concrete in bases, columns, slabs and beams.	○	○
• Demonstrate measurement of formwork to the bases, columns and beams.	○	○
• Demonstrate the measurement of PROVISIONAL SUMS, (reinforcement in this case.)	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Module 6

Plumbing and Drainage

Learning Outcomes

On the completion of this module the student must be able to:

- Describe the following systems:
  - traditional drainage system, (using manholes),
  - Rodding eye system,(using the cleaning eyes)
- Demonstrate how drainage work is measured.

6.1 Introduction

The plumbing and drainage work can be classified as specialist work, similar to the electrical installation in a building. The completed work must be tested for leakages and signed off by a qualified plumber who possesses a license for the trade.

The quantities measured for plumbing and drainage are in most cases provisional due to the difficulty to produce accurate measurements at tender stage. In this course, only the drainage systems will be measured. We will be looking at the rodding eye cleaning system as well as the manhole system. In the former system the provision of cleaning eye entries replaces the building of manholes.

6.2 Manhole system

In **Figure 6.1**, a typical layout of a drainage system with manholes is shown. Two vertical sectional views through a manhole are shown. The information given in the attached schedule refers to the depth from the ground level to the internal level of the channel. The given sizes are the internal measurements of each of the manhole.

6.2.1 Specifications

Earthworks:

- Excavations in ordinary soil.
- Excavated soil to be used for filling and remainder to be spread on site.

Concrete :

- 15 Mpa

Brickwork:

- Plaster bricks
- 1:4 Cement mortar

Plumbing & drainage:

- 110 mm u-pvc drain pipes.
- Allow R1 000,00 for municipal connection.
- Allow for the testing of the drainage system.

When measuring drainage pipe trenches, the Standard System allows us to use either one of two methods.

Consult your Standard System, page 46, clause 5.

In method "A" the trenches must be measured similar to when trenches for strip foundations are measured. Take special note to the depth category as well as the trench width. The pipework will be measured in METRES. In method "B" all the earthwork items may be described in one description, including the laying of the pipework. The unit of measurement is METRES.

The manholes must be measured in accordance with the relevant trades.

Consult your Standard System, page 46, clause 10.

Our measuring list will be as follows:

- Earthwork
- Manholes
- Pipework

The drawing indicates four manholes to be measured. The internal dimensions of manholes 1 and 2 are similar and manholes 3 and 4 is similar. The invert levels of all the manholes are different due to the fall of the pipework.

Definition: Invert

The lowest part of the inner surface of a sewer, pipe channel or tunnel.

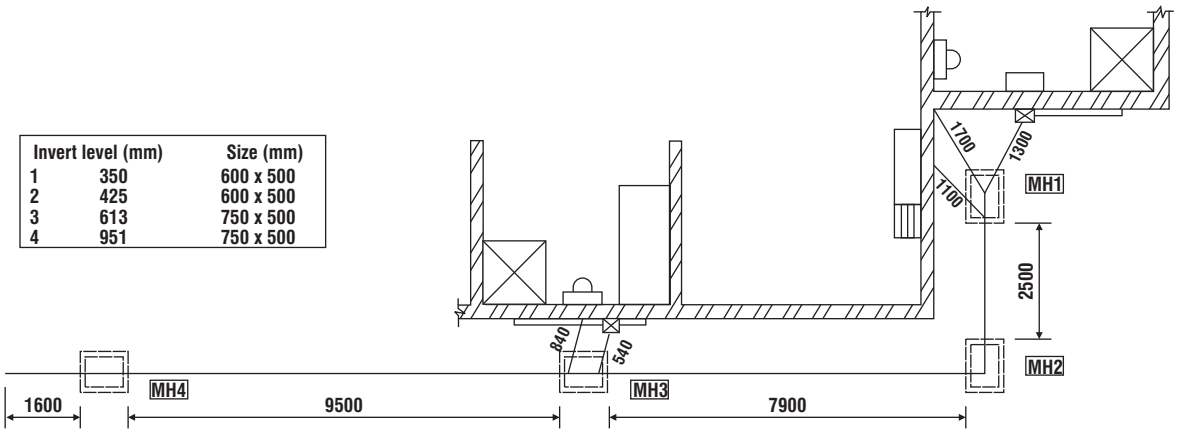


Figure 6.1

Figure 6.1 is a typical plan view layout of a drainage system. The sizes of the manholes as well as the invert levels for each manhole is given in the schedule below the drawing.

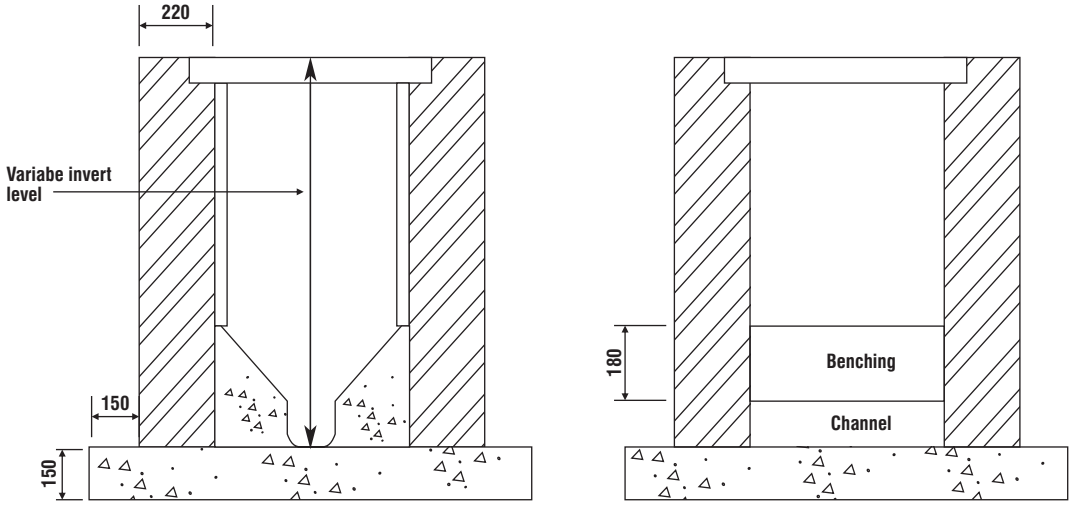


Figure 6.2 VERTICAL SECTIONS THROUGH MANHOLE

Let us start by doing a few waste calculations:

Length and width of the holes for manholes 1 and 2

	0,600	0,500
2 x 220 =	0,440	0,440
2 x 150 =	0,300	0,300
	1,340m	1,240m

Length and width of the holes for manholes 3 and 4

	0,750	0,500
2 x 220 =	0,440	0,440
2 x 150 =	0,300	0,300
	1,490m	1,240m

Depths of manholes:	**mh1**	**mh2**	**mh3**	**mh4**
	0,350	0,425	0,613	0,951
+	0,150	0,150	0,150	0,150
	0,500m	0,575m	0,763m	1,101m

Girth of holes for mh1 and mh2:

2 x (1,390 + 1,240) =5,260m

Girth of holes for mh3 and mh4:

2 x (1,490 + 1,240) = 5,460m

Centre line of the backfilling for mh1 and mh2:

5,260 – 4 x 0,150 = 4,660m

Centre line of the backfilling for mh3 and mh4:

5,460 – 4 x 0,150 = 4,860m

We will now measure all the earthwork items to build the manholes.

1,34 1,24 0,50		Excav. in ord. earth for manhole holes, n.e. 2m dp. fromg.l.			R.o.c. to sides of holes n.e. 1,5m dp. from the g.l.
1,34 1,24 0,58		*M.H.1* *M.H.2*	5,26 0,50 5,26 0,58 5,46 0,76		*m.h.1* *m.h.2* *mh.3*
1,49 1,24 0,76		*M.H.3*	5,46 1,10		*m.h.4*
1,49 1,24 1,10		*M.H.4*	4,66 0,15 0,35 4,66 0,15 0,43 4,86 0,15 0,61 4,86 0,15 0,95		Bckfll. in manholes m.h.1 m.h.2 m.h.3 m.h.4
Item		Keep excav free of water			

Table 6.1

The items for the building of the manholes will now be measured, starting with the concrete bases or floors of the manholes. The dimensions for this item has been calculated.

2	1,34		15 Mpa. Mass conc. in manhole bases.
2	1,24 0,15		M.h.1, m.h.2
	1,49 1,24 0,15		m.h.3, m.h.4

Table 6.2

Let us now measure the brickwork. We will need the centre lines of the 220 mm thick walls. The dimensions of manholes 1 and 2 are the same and manholes 3 and 4 are the same.

Thus: **mh1 and mh2** **mh3 and mh4**

2 (0,600 + 0,500) =	2,200	2 (0,750 + 0,500) =	2,500
+ 4 x 0,220	0,880		0,880
	3,080m		3,380m

The heights of the walls would be the same as the depths of the invert levels as shown on the drawing.

	3,08 0,35		220 mm Thick m.h. bk. wl. In ord. bks. in 1:4 c.m. mix blt. in stretcher bond.
	3,08 0,43		m.h.1 m.h.2
	3,38 0,61		m.h.3
	3,38 0,95		m.h.4

Table 6.3

The next item to be measured now is the benching in the manholes. Benching consists of a weak concrete mixture placed and neatly smoothened off on either side of the half round channels laid inside the manhole.

The Standard System does not specify how it should be measured and leaves it to the discretion of the tenderer.
The description will indicate the sizes of the manholes, and will be measured in NUMBER.

	2		Weak conc. mixture in benching 180 mm extreme height, in m.h. size 600 x 500 mm. m.h.1, m.h.2
	2		Ditto, but in m.h. size 750 x 500 mm m.h.3, m.h.4

Table 6.4

The items left to complete the 'taking off' of the manholes are the channels, plastering, manhole covers as well as the holes in the brick walls that will allow the pipework into the manholes.

	1	110 mm h.r. pvc straight channel 750 mm long encased in conc. benching e.m. mh. 4			Vert. pls. in confined areas of m.h. Internal girths m.h. 1 & 2 2 (600 + 500) = 2,200m m.h. 3 & 4 2 (750 + 500) = 2,500m Heights m.h. 1 = 0,425 – 0,180 =0,170 m m.h. 2 = 0,425 – 0,180 = 0,245 m m.h. 3 = 0,613 – 0,180 =0,433 m m.h. 4 = 0,951–0,180 =0,771m
	1	Ditto,ditto, but with two branches, ditto. mh. 3			
	1	110 mm pvc h.r. channel with 95 deg. Bend ditto. m.h.2			
	1	110 mm h.r. pvc straight channel, but with three branches,ditto. m.h. 1			
	4	450 x 450 mm cast iron m.h. steel cover and frame.		11	Leave or form hole for 110 mm dia. Pipe in 220 mm wl. No. of holes m.h. 1 3 m.h. 2 2 m.h. 3 4 m.h. 4 2 11no.

Table 6.5

Alternatively, you will notice that the Standard System also allows for manholes, and the like, to be measured in NUMBER. The description must include all the different trades we have just measured. To measure the pipework, you must remember the information mentioned at the beginning.

You will notice that the depth at manhole no. 4 is not deeper than 1 metre. Therefore we can keep the trench width the same for the full length of the system.

Width of trench = 0,110 + 2 x 0,300 = 0,710m

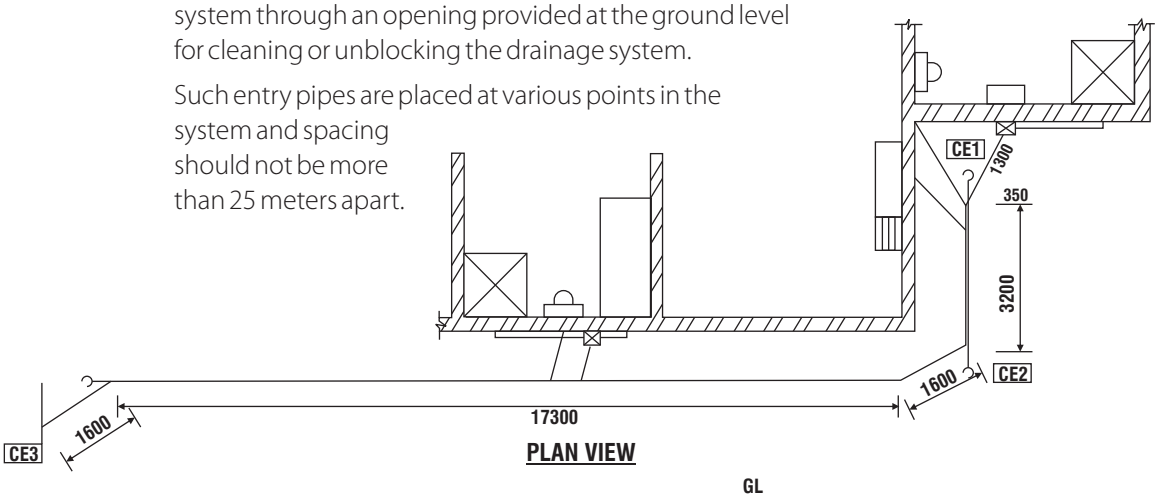
	19.30		Excav. in ord. earth for drainage n.e. 1 m dp. and 710 mm wide, and lay 110 mm u-pvc pipe, incl. making provision for r.o.c. water and bckfil. Of excav. mat. Note: All the pipe lengths are provisional 1,900 0,900 1,000 3,000 4,500 6,000 2,000 =19,300m
	Item		Allow for testing sewer system
	Item		Allow the prov. amount of R1000,00 (One Thousand Rand) for mun. connection. & Allow for attendance upon mun. workers. & Allow for profit

Table 6.6

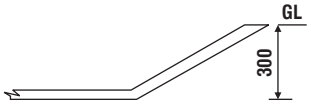
6.3 The rodding iron drainage system

The rodding iron drainage system does not have manholes, but allows entry into the system through an opening provided at the ground level for cleaning or unblocking the drainage system.

Such entry pipes are placed at various points in the system and spacing should not be more than 25 meters apart.



PLAN VIEW



C.E.1 ELEVATION

Figure 6.3

The drawing above shows the plan view of a rodding eye drainage system. All the relevant information is given on the drawing.

6.3.1 Specifications:

Earthworks:

- Excavations is in ordinary soil.

Drainage:

- 110 mm diameter u-pvc drainage pipes laid to 1:40 fall.
- Use method 'B' to measure the work.
- The municipal connection is in place before the building work commenced.
- Allow for a plain bend at the 2 water closets, 1 sink, 3 cleaning eyes and 2 in the pipework

Let us first establish all the extras required in this drainage system.

Plain bends	- 8	Gulley head & p-tap	- 1
Y-junctions	- 5	Inspection eye stopped ends	- 3
Double Y-junction	- 1		

Let us measure the pipes, extras and other relevant items to install this drainage system.

	3,00	Excav. in ord. earth n.e. 1m dp. & 710mm wide for 110 mm u-pvc pipe laid to 1:40 falls incl. r.o.c., water & bckfll. of excav. mat.		3	Extra for110mm u-pvcs.e.
	11,00				
	2,00				
2	3,00				
	1,00				
	1,10	Width of trench:		1	'Universal' gulley head & frame.
		0,110 + 2(0,300) = 0,710m			
	0,35				
	0,43				
	0,75	Ditto, but vert. for i.e. entries.			&
		1:40mm fall means the pipe falls 1m for every 40m. Thus 25mm for every metre.			Extra for u-pvc p-trap.
		At point 1 the depth is 350mm. At point 2 the depth is + 3 x 25mm = 425mm. At point 3 the depth is 350mm + 16 x 25mm = 750mm.		Item	Allow for testing sewer system
	8	Extra for 110mm u-pvc plain bend.			
	5	Extra for 110mm u-pvc Y-junction			
	1	Ditto, but double y-junction			

Table 6.7

Activity 6.1

1. What are the features of the traditional manhole drainage system?
2. What are the features of the rodding eye system using cleaning eyes?
3. How is drainage work measured?

Self Check

I am able to:	YES	NO
• Describe the following systems:	○	○
o traditional drainage system, (using manholes),	○	○
o Rodding eye system,(using the cleaning eyes)	○	○
• Demonstrate how drainage work is measured.	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Module 7

Timber Roof Construction

Learning Outcomes

On the completion of this module the student must be able to:

- Demonstrate how to measure:
  - o a lean-to roof construction
  - o a roof with a gable end and a hip end
  - o bolted or nailed trusses
  - o prefabricated trusses

7.1 Introduction

A timber roof truss is a structural framework of timbers designed to bridge the space above a room and to provide support for a roof. Trusses usually occur at regular intervals, linked by longitudinal timbers such as purlins. The space between each truss is known as a bay.

7.2 Measurements

A line diagram of a roof truss is shown in **Figure 7.1**. Take special note of the different parts of the truss in order for you to be familiar with the terminology used.

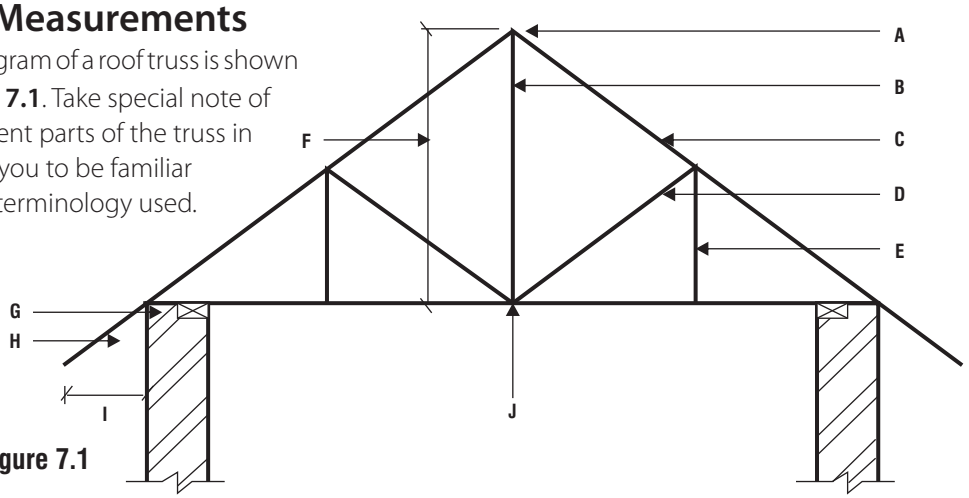


Figure 7.1

- Arrow **A** shows to the highest point of the truss and is called the **APPEX**. The same point on a roof is called the **RIDGE**.
- Arrow **B** shows to the member in the centre of the truss and is called the **KING POST**.
- Arrow **C** shows to the **RAFTER**. On a full truss we will have two rafters.
- Arrow **D** shows to a **DIAGONAL STRUT** and in this truss we also have two diagonal struts.
- Arrow **E** shows to another vertical member and is called a **QUEEN POST**. This truss also has two queen posts.
- Arrow **F** shows to a dimension and is called the **RISE** of the truss.
- Arrow **G** shows to the **WALL PLATE**.
- Arrow **H** shows to a space and is called the **EAVE** space.
- Arrow **I** shows to another dimension and is called the horizontal **EAVE DISTANCE**.
- Arrow **J** shows to the horizontal member of the truss and is called the **TIE BEAM** of the truss.

Definition: Eave

The lower part of a roof projecting beyond the face of a wall.

- If you consult your Standard System, you will find that the measurer has different methods that can be used to measure a roof construction.
- The complete roof construction must be fully described in such a way as to allow the tenderer to price the work. In this instance the roof is measured in NUMBER.
- If the roof construction is made up of pre-fabricated trusses, also known as plate-nailed or gang-nailed trusses, the Standard System is very clear as to how the work must be measured.

Consult your Standard System, page 30, clause 5.

- If the trusses are to be assembled on the site, the truss members at all intersections must be joined together with bolts, with allowance made for timber connectors between timbers.

Consult your Standard System, page 30, clause 4.

We will now look at a typical timber roof construction made up of bolted trusses. See the plan view of this roof shown in **Figure 7.2**, a sectional view through the roof in **Figure 7.3**, and the detail of the hip rafter in **Figure 7.4**. The drawing shows a hip end on the one end and a gable end at the other end.

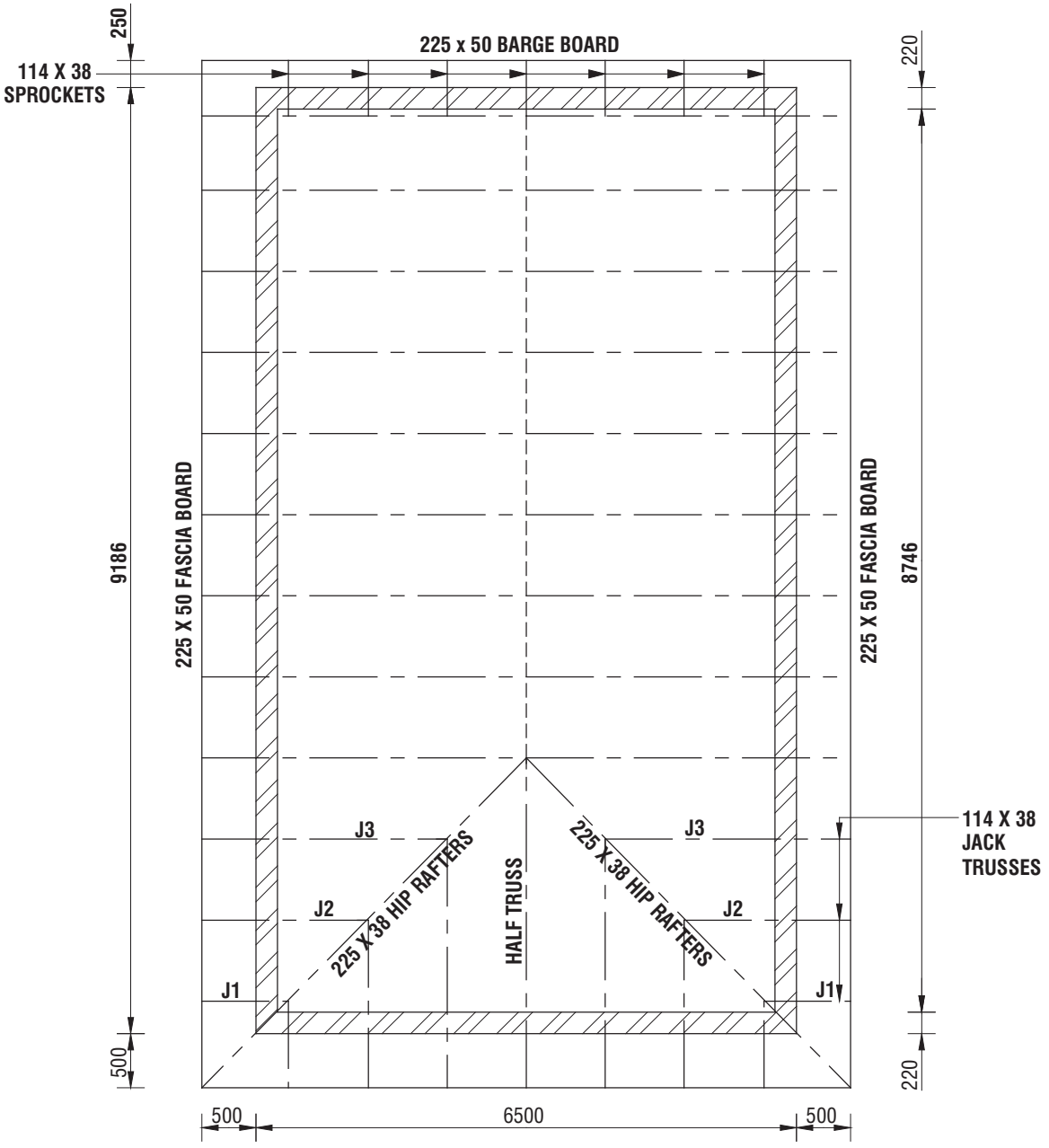
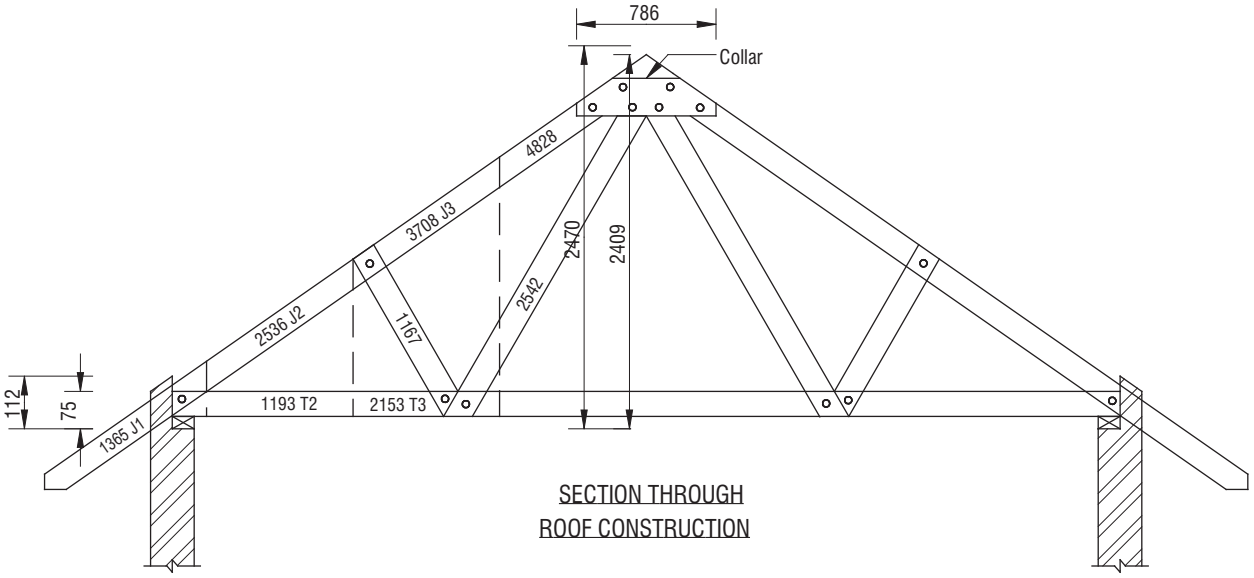
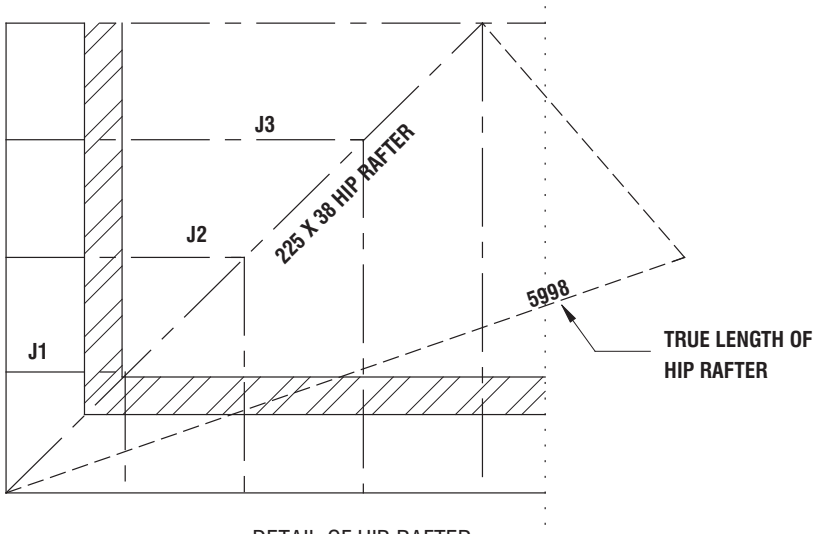


Figure 7.2 PLAN VIEW OF ROOF CONSTRUCTION



SECTION THROUGH
ROOF CONSTRUCTION

Figure 7.3



DETAIL OF HIP RAFTER

Figure 7.4

Definition: Hip
The external angle formed by the intersection of two inclined roof surfaces. The opposite of a valley (the internal angle).

7.2.1 Specifications

Carpentry & Joinery:

- All timbers are Sawn South African Pine.
- Wrought (smooth) all exposed timbers.
- 114 x 38mm Wall plate.
- Treat wall plate with carbolinium oil.
- 200 x 30mm Timber fascia and barge boards.

Definition: Barge board
A board fixed along the edges of a gable.

Painting:
- Knot, prime, stop and paint all exposed timbers.

Metalwork:
- 10mm Diameter mild steel bolts with one nut and two washers.
- Mild steel timber connectors between timbers.

Roof covering:
- Plain cement roof tiles 265 x 165mm laid to 60mm lap on 38 x 38mm
- Timber battens and approved insulation below battens.
- 250mm half round ridge and hip tiles.

7.2.2 Measuring list

- W.p. & treatment
- Hip rafters
- Fascias
- Full trusses
- Jack trusses
- Barge boards
- Half truss
- Sprockets
- Roof covering

Note:
More detail will be added to the items on the measuring list during the 'taking off' process. A good measurer will at all times strive top measure systematically not confuse the person who will have the responsibility to do the checking.

Thus, let us start by determining the length of the wall plate.

5,000 – (2 x 0220) = 4,560
2 x 8,746 = 17,492
2 x 0,114 = 0,228
22,280m

Remember that it is required that the wall plate needs be treated for protection. Provision must also be made to ensure the wall plate rests on a level surface.

The next item on the list is the full trusses. From the drawing you will notice that we have 9 (nine) full trusses to measure. All nine trusses are similar, thus if we concentrate on one truss only whilst measuring, all the items measured will then be multiplied by nine. It is important also to know the truss members as we will use them for our sign posting (reference notes).

			Wall plate
	22,28		114 x 38 mm S.S.A.P. tbr. w.p. incl. Bedding in c.m.
	22,28 0,30		Treat tbr. w.p. with carbolinium oil.
			Girth: 2 x 114 = 0,228 2 x 38 = 0,076 0,304m
			END OF WALL PLATE

Table 7.1

Please consult your Standard System to measure the structural timbers, page 30, clause 4.

We will now measure all the items for one full truss first. All the items will then be multiplied by 9, as all the full trusses are identical.

- All the timbers not longer than 2,4 m.
- All the timbers longer than 2,4 m but not longer than 3,9 m.
- All the timbers longer than 3,9 m but not longer than 6,6 m.
- 14 Bolts and 14 timber connectors.
- Labours to the truss ends.
- Routing of the timber rafter ends, meaning the smooth planning of the rafter ends.
- Painting of the exposed timbers.

			The following in measurement of 9 No. full trusses fixed approx. 3m above the ground level				
9				9			
2	1,17		114 x 38 mm S.S.A.P. tbr. n.e. 2,4m long. *Diag. strut*	2	2		Once vert. & once hor. Cut to tbr. rafter ends.
	0,79		*Collar*	9			
9				2	2		Wrought rafter ends approx. 550mm long.
2	2,54		Ditto, but exce. 2,4m n.e. 3.9m long. *Diag. strut*	9			
				2			
9	6,27				0,55		
9					0,30		Pt. tbr. rafter ends.
2	4,83		Ditto, but exce. 3,9m n.e. 6,6m *Tie* *Rafter*				Total girth of rafter:
			Length = 6,500 – 2 x 114 = 6,272m				2 x 114 = 0,228
9							2 x 38 = 0,076
	14		10mm Dia. Stl. Bolt 100mm long w. 1 nut & 2 washers.				0,304 m
			Length = 2 x 38= 0,076 – Tbrs. 2 x 2 = 0,004 – washers 0,010 –nut 0,010 – extra leverage 0,100m				
			&				
			Mild stl. tbr. connector				END OF 9 No. FULL TRUSSES

Table 7.2

The next item in our roof construction to be measured, as indicated on our measuring list, is the half full truss. Most of the items measured on the full trusses will be repeated.

		The Following in measurement of 1No. half full truss fixed approx. 3m above the ground level		7		Mild steel tbr. connectors a.b.
	1,17					
	0,39	114 x 38mm S.S.A.P. tbr. n.e. 2,4m long. *Diag. strut* *Collar*		1		Wrought rafter ends approx. 550mm long a.b.
		0,786 ÷ 2 = 0,393 m				
	2,54			0,55		Pt. tbr. rafter end sa.b. once vert. & once hor. cut to tbr. rafter ends.
	3,14	Ditto, but exce. 2,4m n.e.3.9m long. Diag. strut		0,30		
		Tie		1		Once vert. & once hor. cut to tbr. rafter end a.b.
		6,272 ÷ 2 = 3,136 m				
	4,83	Ditto, but exce. 3,9m n.e. 6,6m long.				
		Rafter				END OF 1 No. HALF FULL TRUSS
	7	10mm Dia. St. Bolt 100mm long w. 1 nut &2 washers a.b.				

Table 7.3

Before we measure the hip rafters, it would be expected that you fully understand the detailed drawing of the hip rafter shown in **Figure 7.4**.

Note:
We will only measure the rafters and the additional work that must be done.

			The following in measurement of 2No. hip rafters fixed approx.. 3m above the ground level
2	6,00		225 x 38mm S.S.A.P. tbr. exce.3,9m n.e. 6,6m long.
2	2		Wrought rafter ends approx. 600mm long.
2	0,60 0,30		Pt. tbr. rafter ends
	2		Twice vert. & twice splayed cuts at the top ends. & Twice vert. twice splayed & once hor. cut at the bottom ends
			END OF 2 No. HIP RAFTERS

Table 7.4

We will now measure jack trusses. Please study the sectional view through the roof construction shown in **Figure 7.3**. The vertical dashed lines on the left side of the truss shows the jack trusses at the various positions. These positions were established as follows.

- Measure the horizontal distances from the wall to where the rafters meets with the hip rafter.
- Use the same distances and measure horizontally on the tie beam of the full truss.
- Now draw vertical lines from the various distances marked on the tie beam.

Now that we have established our jack trusses, we can proceed to measure them.

		The following in measurement of Jack trusses fixed approx.. 3m above the ground level.	4 / 1		10mm Dia. Stl. Bolt 100mm long w. 1 nut &2 washersa.b.
			4 / 3		J2
					J3
					&
					Mild stl. Tbr connector
4 / 1,37		114 x 38 mm S.S.A.P. tbr. n.e. 2,4m long.	4 / 3		Once vert. & once hor. Cut to tbr. rafter ends.
4 / 1,19		*Rafters (J1)*			&
4 / 2,15		*Ties (J2)*			Wrought rafter ends approx. 550mm long.
4 / 1,17		*Ties (J3)* *Diag. strut (J3)*	4 / 3	0,.55 0,30	Pt. tbr. rafter ends.
4 / 3,71		Ditto, ditto, but exce. 2,4m n.e. 3,9m long.			END OF JACK TRUSSES
4 / 2,54		*Rafters (J3)*			
		Rafter (J2)			
4 / 1		Once vert. splayed cut to ties & rafters.			
4 / 2 / 2		*Ties(J1)*			
		Ties & rafters (J2, J3)			

Table 7.5

Now we are left with the measurement of the timber sprockets. The reason for sprockets would be to provide solid timber for the fixing of the barge boards. The sprockets are nailed to the side of the timber rafters, also built into the gable brickwork.

6 / 0,52		114 x 38 mm S.S.A.P. tbr. sprockets in short lengths n.e. 2,4m long.
		Length = 0,050 rafter to wall
		0,220 wall
		0,250 Verge distance
		0,520m
6		Vert. plumb cut to ends of tbr sprockets
		&
		Wrought ends of tbr. sprockets approx.. 250 mm long.
6 / 0,25 0,30		Pt. to exposed tbr. a.b.
		END OF TIMBER SPROCKETS

Table 7.6

All timber trusses needs to be secured by either fixing bolt or steel hoop iron which is built into the brick wall. If the drawing requires bolts, the length of the bolt will have to be established. Similarly also if hoop iron is required. In both cases the unit of measurement will be in NUMBER.

We now need to measure the timber fascia and barge boards. The fascia boards are fixed to the timber rafter ends and the barge boards to the timber sprockets. These boards are fully wrought and ready to be painted.

Definition: Fascia

A board fixed horizontally to the lower ends of the rafters. Also forms the outside board of a boxed eave.

We now need to calculate the length of the fascia board. The length of the barge board would be the same length as the truss rafters.

The length of the fascia board is;

2 (9,186 + 0,500 + 0,250) = 19,872
5,000 + 0,500 + 0,500 = 6,000
25,872 m

The last few items would be all the work to the roof covering of this dwelling.

The measuring list of the work would be;

- Roof tiles, tile battens, insulation
- Ridge cover
- Hip cover
- Hip stopped ends
- Close ends of hips
- Close intersection @ hips & ridge.

	25,87	225 x 50 mm W.S.A.P. tbr. fascia nailed to ends of tbr. rafters.
	25,87 0,55	Pt. tbr. fascia brd. exce. 300mm girth. Girth: 2 x 0225 = 0,450 2 x 0,050 = 0,100 0,550 m
2	3,71	225 x 50 mm W.S.A.P. tbr. barge brd. nailed to ends of tbr. sprockets.
2	3,71 0,55	Pt. tbr. b.b. exce. 300mm girth.

Table 7.7

Sloping length of the roof = 3,714 + 0,050(projection over the fascia = 3,764m.
Horizontal length of the roof = 9,186 +0,500 + 0,250 + 0,050 = 9,986m.

2	9,99 3,76	Plain cement roof tiles 265 x 165mm laid to 60mm lap on 38 x 38mm tbr. battens and approved insulation under battens.
	6,99	250mm half round ridge tiles. Length = 9,986 – Half of 6,000 = 6,986m
2	4,66	Ditto, but for hip tiles Length = 4,614 + 0,050 = 4,664m
	1	Extra for ridge s.e.
	2	Close bot. ends of hips.
	1	Close opening @ intersection between 1 ridge & 2 hips. End of roof covering

Table 7.8

If the specification of the same roof requires the roof trusses to be changed to prefabricated roof trusses, the full trusses, half truss and the jack trusses would be measured differently as illustrated below.

Consult your standard system, page 30 and clause 5.

	9		Double pitched pre-fab. full truss w. 5m span, 1,815 rise, two diag. struts & 500mm hor. eave projections.
	1		Single pitched half truss, but w. 2,5m span & two diag. struts.
			Note: Jack 1 is not a truss. Therefore it is not measured as one.
	2 Sets		Single pitched pre-fab. jack truss w. 916mm span, 1951mm rafter & 500mm eave projection.
	2 Sets		Ditto, but w. 1656mm span, 3852mm rafter, 1diag strut & 500mm eave proj.

Table 7.9

Activity 7.1

1. How do you measure bolted or nailed trusses?
2. How do you measure prefabricated trusses?

Self Check

I am able to:	YES	NO
• Demonstrate how to measure:	○	○
o a roof with a gable end and a hip end	○	○
o bolted or nailed trusses	○	○
o prefabricated trusses	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Module 8

Timber Casement Window

Learning Outcomes

On the completion of this module the student must be able to:

- Demonstrate how timber windows are measured.
- Demonstrate how glazing sizes are calculated.
- Demonstrate how the different categories for glazing are established.

8.1 Introduction

When measuring timber windows, it is of utmost importance that you know the different parts of the window. If you consult your Standard System, you will find that timber windows are measured under the trade 'carpentry & joinery'.

Consult your Standard System, page 30.

On page 31 and clauses 7 and 8 speak about sashes, fanlights, mullions, transoms and frames. Fabricators normally provide a catalogue in which windows of standard sizes are shown.

Definition: Transom
An intermediate horizontal member of a window or door frame.

Definition: Mullion
An intermediate vertical member of a window or door frame.

These windows will all have codes or reference numbers that are used to differentiate between types of designs. The measurer can then make use of these reference numbers.

Definition: Casement
Window sash hinged or pivoted in the vertical plane.

In such cases the size of the window must be provided, and the window must be fully described with reference made of the code or reference number. The window will then be measured in NUMBER.

There are also referred to the term 'purpose made'. In this instance no catalogue will have any information of it as it will be made to a specified size and design. In cases such as this, the timber window must be measured as required by the Standard System.

A line diagram of a timber window frame is shown in Figure 8.1 below. Please take special note of the different members of the frame;

Arrow A - **HEAD**.

Arrow B - **STILE**
A window always has two stiles.

Arrow C - **TRANSOME**
The horizontal member.

Arrow D - **MULLION**
The vertical member .

Arrow E - **CILL**
The bottom member.

Spaces F1 & F2
- where the **FANLIGHTS** will be fitted.

Spaces G1 & G2
- where the **SASHES** or **CASEMENTS** will be fitted.

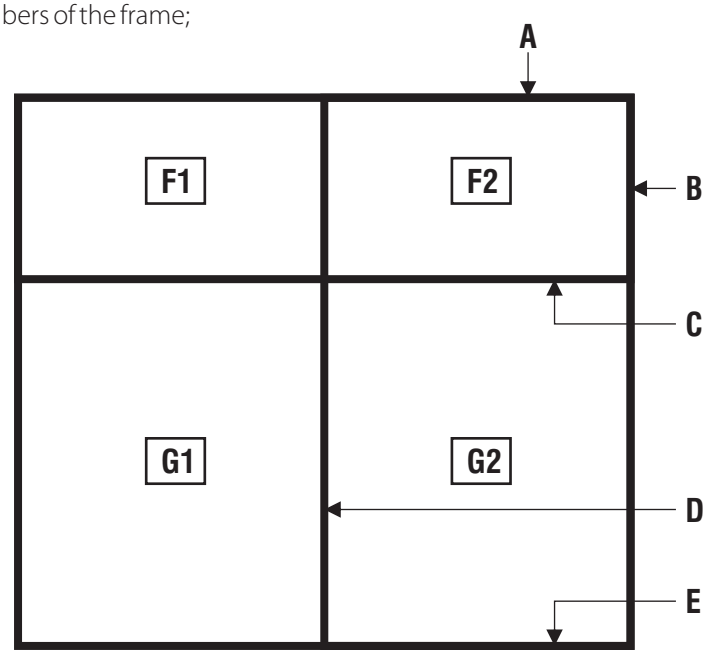


Figure 8.1

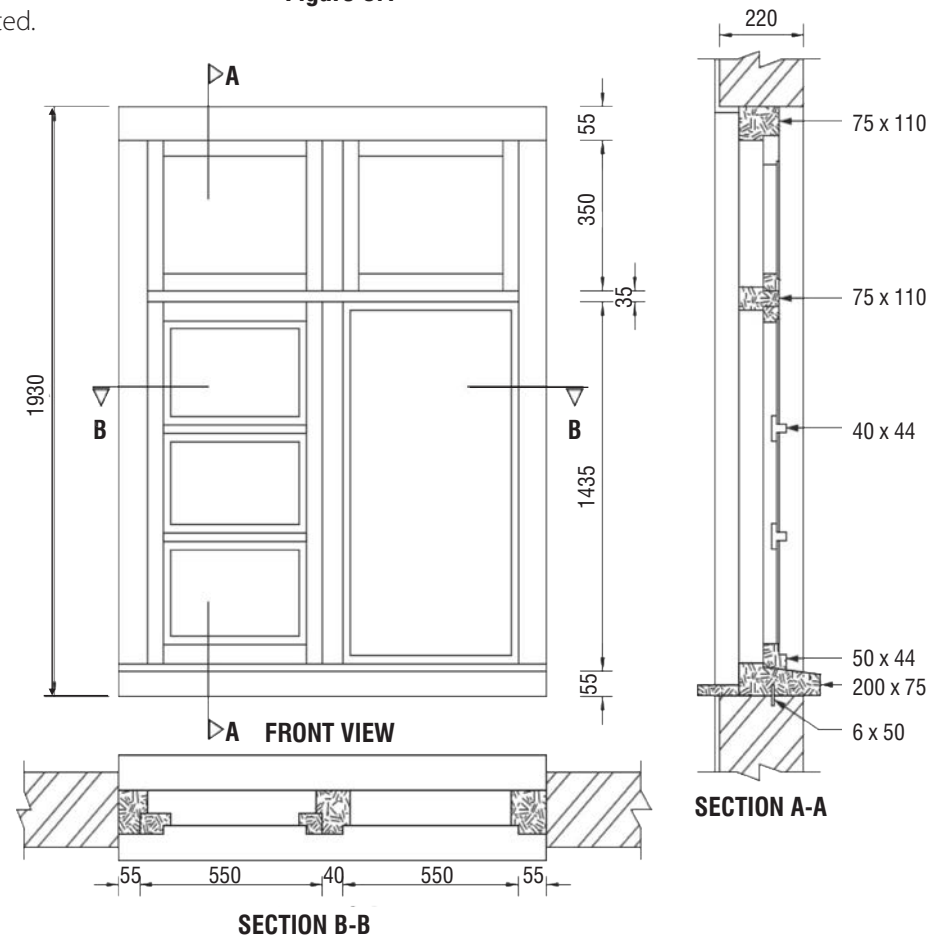


Figure 8.1 Timber window and sections

Study the drawings of this window carefully before looking at the measurement of the timber window below.

Note:
The window has two fanlights, one fixed light and one three glass paned sash.

8.2 Specifications

- All timbers to be meranti.
- Priming to backs of frame.
- Two coats clear varnish to exposed timber surfaces.
- Brass hinges, Two per fanlight and three per sash.
- Brass stay and fixing pin to sash and fanlights.
- 3mm Thick clear float glass.

The measurement will be strictly according to the following measuring list;

- Frame:
  - Stiles
  - Head
  - Sill
  - Transom
  - Mullion
  - Priming
  - Varnish
- Fanlights and sash
  - Varnish
  - Glazing
  - Ironmongery

Note:
The drawing does not show any horns to the frame, therefore our measurements will be net. Allowance will be made for mortise and tenon joints at intersections. The brickwork around the window is also not measured.

The stiles of the frame as well as the head has one rebate and can be measured together. Let's use the measurement of 20mm for the rebate.

Definition: Construction joint
Joint between one pour which has been completed and allowed to harden and another pour placed against it.

Thus:
The length of the stiles and the mullion would be 1,930m
The length of the head, transom and cill is the same the width of the window, thus 1,225m.

The head and the stiles can be measured together as all requires one rebate.
The mullion and the transom can be measured together as both requires two rebates.

Definition: Expansion joint
Joint arranged between sections of wall ,floors, roof etc. to allow them to expand or contract with rise or fall of temperature.

The cill must be measured separately as it requires two rebates, it must be weathered and is also grooved.

We will now measure the window frame bearing in mind the information above. The description will first make reference of the timber size and must describe the machining work to it.

The next step will be to measure the priming of the frame. This would be all areas against the wall. The frame is primed to make sure the timber is waterproofed. The exposed areas of the frame will be varnished.

2 / 1,93		110 x 75 mm Meranti tbr. once rebated. *Stiles*
1,26		*Head*
1,26		110 x 75 mm ditto, but twice rebated *Transome*
1,93		*Mullion*
1,26		200 x 75 mm Meranti tbr., twice rebated, once weathered and once grooved. *Cill*

Table 8.1

Consult your Standard System, page 57, clause 6 for the measurement of the painting.

Varnish to the timber frame is measured in SQUARE METRES. We are now going to calculate the girth areas of all the timbers of the frame.

Girth of the stiles and the head would be identical:
2 x 75 + 110 = 0,260m.

Girth of the mullion and transome also the same:
2 x 75 + 2 x 110 = 0,370m.

Girth of the cill;
2 x 75 x 200 = 0,350m.

2 / 1,93		Prime backs of tbr. window frame.
2 / 1,26		
2 / 1,93		Two cts. Clear varnish to tbr. window frame. *Stiles*
0,26		
1,26		*Head*
0,26		
1,93		*Mullion*
0,37		
1,26		*Transome*
0,37		
1,26		*Cill*
0,35		

Table 8.2

To measure the fanlights and sash, you need to consult your Standard System, page 31 and clause 7. The element must be fully described and measured in NUMBER. Also consult your painting trade, page 57 and clause 7.

The full flat area must be used, thus measured in SQUARE METRES.

2		550 x 350 mm Meranti tbr. fanlight frame 50 x 44mm, once rebated.
1		550 x 1435mm Meranti sash frame 50 x 44mm, once rebated and two 40 x 44mm twice rebated glazing bars.
2	0,55	Two cts. clear varnish to tbr. fanlights and sash.
	0,35	
	0,55	*Fanlights*
	1.44	*Sash*

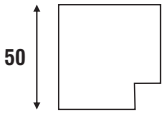
Table 8.3

We will now measure the glass.

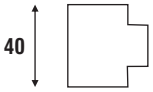
Consult your Standard System, page 55, clause 1.

Glass must be grouped in the different categories but also according to the type, quality, thickness and size. Clause 3 also requires the method of glazing and the material that will receive the glass.

Let's say, the rebate in the frame where the glass is fitted into is 15 x 15mm deep.



Thus 50 – 15 = 35mm



40 – 2 x 15 = 10mm

The size of the fanlight glass would then be:
Length = 0,550 – 2 x 0,035 = 0,480m
Width = 0,350 – 2 x 0,035 = 0,280m

The sizes of the panes would be:
1,435 – (2 x 0,035 + 2 x 0,010) = 1,345 ÷ 3 = 0,448m

Thus, the sizes of the fixed light = 0,450 x 1,345 m
Thus, the length is = 0,480 m
and the width is = 0,448 m

The term, 'ironmongery' would refer to items like hinges, stays, locks and any other decorative fixtures.

2	0,48	3mm Thick clr. float glass exce. 0,1n.e. 0,5m² in tbr. frame. Fanlight
	0,28	
3	0,48	*Sash*
	0,45	
	0,48	*Fixed light*
	1,35	

Table 8.4

2	2	Brass hinges fixed to tbr. frame
	3	*Fanlights*
2		*Sash*
	2	Brass stay and fixing pin
	1	*Fanlights*
		Sash

Table 8.5

Activity 8.1

1. How are timber windows measured?
2. How are glazing sizes calculated?
3. How would you establish the different categories for glazing?

Self Check

I am able to:	YES	NO
• Demonstrate how timber windows are measured.	○	○
• Demonstrate how glazing sizes are calculated.	○	○
• Demonstrate how the different categories for glazing are established.	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Table 7.3

Module 9

Levelling of Uneven Ground

Learning Outcomes

On the completion of this module the student must be able to:

- Demonstrate the method used to measure open faced bulk excavations.
- Demonstrate the calculation of average depths areas.

9.1 Introduction

The standard system of measuring builders work requires all excavations to be measured in CUBIC METRES. Levelling of uneven ground would mean to reduce or fill an open stand to a required level.

Consult your Standard System, page 6 clause 6.

If you consult your standard system, page 6 clause 6, you will notice that no distinction needs to be made for depths because excavations are not done into the ground. Thus no allowance for water or risk of collapse is necessary.

What you would need and do to be able to measure open faced excavations;

- A site plan.
- The existing ground levels at various points.
- Divide the open stand in known areas.
- Determine the existing ground levels at the corners of each area.
- You now need to calculate the average depth of each area.
- After the reduced level is deducted from the average depth calculated, the answer could be either positive or negative. If negative it would mean the area needs to be FILLED, and positive, it would mean the area needs to be CUT.

The next drawing illustrates a typical plan and section of an uneven ground, which has to be excavated to form a level building site. We will now measure the bulk excavation in open faces.

9.2 Specifications

- Excavated soil must be carted off the site.
- Allow 10% for excavations in soft rock.
- Allow 15% for excavations in hard rock.
- The spot levels provided are in relation to a datum level of 80,000.
- Excavate the building site area to an level plane of 85,700.

Definition: Datum

A clearly defined and accessible marker from which the required levels of a building or site can be readily measured during construction.

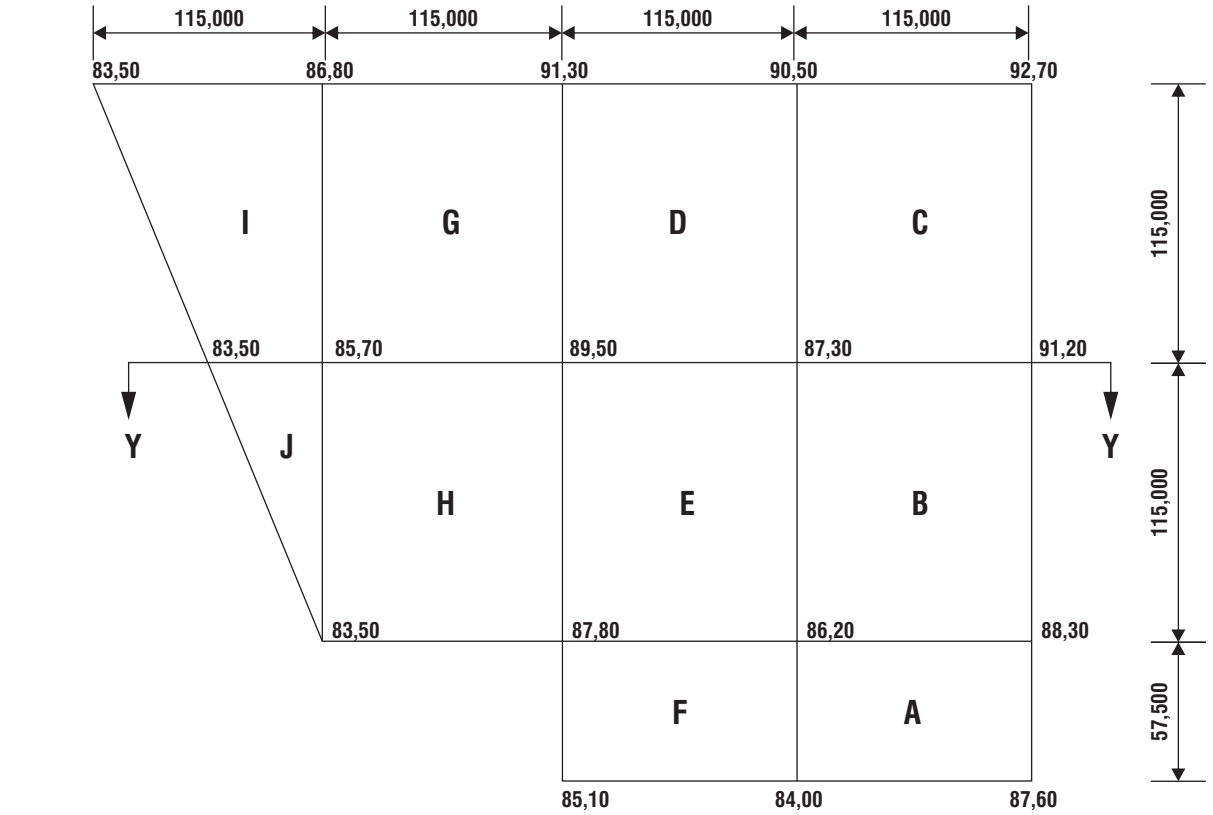


Figure 9.1

We will start by doing detailed waste collections for the average depths for each section as shown on our drawing. Let us start with area A and end with area J. The procedure would be to add all the levels for each area and divide by the amount of levels for that area.

The depth of CUT or FILL will be determined by deducting the 85,700 from the answer.

Area A	Area B	Area C	Area D	Area E	Area F
87,600	88,300	91,200	87,300	86,200	84,000
88,300	91,200	92,700	90,500	87,300	86,200
84,000	86,200	87,300	89,500	87,800	87,800
86,200	87,300	90,500	91,300	89,500	85,100
346,100	353,000	361,700	358,600	350,800	343,100

Table 9.1

All the answers above are divided by 4 to arrive at the answers below less the new level.

86,525	88,250	90,425	89,650	87,700	85,775
-85,700	-85,700	-85,700	-85,700	-85,700	-85,700
0,825m	**2,550m**	**4,725m**	**3,950 m**	**2,000m**	**0,050 m**

Table 9.2

Area G	Area H	Area I	Area J
86,800	85,700	83,500	83,500
91,300	89,500	86,800	85,700
89,500	87,800	85,700	83,500
85,700	83,500	83,500	
353,300	346,500	339,500	252,700

Table 9.3

252,700 ÷ 3 = 84,233 – 85,700 = - 1,467 m (AREA J)

All divided by 4 as above;

88,325	86,625	84,875
- 85,700	-85,700	- 85,700
2,625m	**0,925m**	**- 0,825m**

We now have the calculated average depths of each area. Remember, all positive depths are areas to be CUT and all negative depths are areas to be FILLED.

Table 9.4

You will notice that areas B-E, G, H are all squares with the same side lengths and can be grouped together. Areas A,F,I and J are different shapes and can be grouped together, but keeping cut and fill areas apart.

Let us now measure up all the items as listed in the check list for this open stand.

		Open faced bulk excav.			115.00	From excav, soil,fill&
		(cubed x 115 x 115=)			86,25	compact.
	2,55	B			0,83	
	4,72	C		0,5	115,00	I
	3,95	D			57,50	
	2,00	E			1,47	J
	2,63	G				
	0,93	H				
		&				
		Excav. soil avail. For fill & rem. to be c.a.				Ave. Length 115 + 57,5 ÷ 2 = 86,250m
					10%	
	115,00	(cubed x 115 x 115= M^3)				Extra over bulk excav. for soft rock
	57,50	Ditto				
	0,83					
	115,00	A				
	57,50					
	0,05	F			15%	
		&				Extra over bulk excav. for Hard rock
		Excav. soil avail. For fill & rem. to be c.a.				END OF OPEN FACED BULK EXCAVATIONS.

Table 9.5

Activity 9.1

1. Give a detailed description of the method used to measure open faced bulk excavations.
2. Explain how to calculate average depth areas.

Self Check

I am able to:	YES	NO
• Demonstrate the method used to measure open faced bulk excavations.	○	○
• Demonstrate the calculation of average depths areas.	○	○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Module 10

Preparing and Drawing of Bills of Quantity

Learning Outcomes

On the completion of this module the student must be able to:

- Demonstrate the term 'squaring' & the steps that must be followed.

10.1 Introduction

Squaring is done by a person who fully understands the 'taking off' procedure and who has the ability to check the work of the 'Taker off' measured from the information on the drawings and specifications used.

10.2 Squaring and checking dimensions

The first step when squaring would be to check if the waste calculations (collections done before the 'taking off') and side casts (collections done during 'taking off') are correct. See **Table 10.1**.

1. This procedure would begin by checking the correctness of all the dimensions taken from the drawings. All the dimensions used not given on the drawings, must clearly show how they were calculated.

   All the dimensions which the checker agrees with must be clearly ticked The checker does not have the authority to make any corrections to the work of the 'taker off' but must bring it to his/her attention who will have to do the corrections if he/she is in agreement.

			Collections: Length 3,785 (Waste calculations) 5,330 9,115m Excav. in ord. earth for s.t.n.e. 2m dp. fromg.l. Depth 0,300 0,250 (Side casts) 0,550 m

Table 10.1

2. The second step would be to check if the dimensions inserted in the dimension column next to the item described in the description column, is correct. The checker must also show by using a tick that the dimensions are correct. If it is found that a dimension is wrong, the whole sequence must be cancelled out and the correct dimensions must be inserted directly below.

Note:
The word NIL is written in the answer column. See **Table 10.2**.

			Collections: Length 3,785 (Waste calculations) 5,330 9,115m
	~~8,12~~ ~~0,70~~ ~~0,55~~	Nil	Excav. in ord. earth for s.t.n.e. 2m dp. fromg.l.
	9,12 0,70 0,55		Depth 0,300 0,250 (Side casts) 0,550m

Table 10.2

The third step would be to multiply the groups of dimension sequences and to insert the answers in the answer column of the dimension sheet. See **Table 10.3**.

			Collections: Length 3,785 (Waste calculations) 5,330 ✓ 9,115m ✓
	~~8,12~~ ~~0,70~~ ~~0,55~~	Nil	Excav. in ord. earth for s.t.n.e. 2m dp. fromg.l.
	9,12 0,70 0,55	✓ ✓ ✓	Depth 0,300 ✓ 0,250 ✓ (Side casts) 0,550m ✓
		3,51	✓

Table 10.3

The fourth step would be to have such multiplications checked by another checker before final answers are established.

Note:
Once all the dimension sheets of a particular section, have been checked and rechecked, it is important to number each description column at the bottom. These numbers will be used as reference numbers on the abstract sheets.

10.3 Abstracting

Abstracting is a summary or gathering together of identical or similar items with their respective quantities into their correct order within their respective trades, in preparation for writing the bills of quantities.

Abstracting can only begin once the checking process has been completed and the 'taking off' numbered in the correct order. Abstracting is the first stage of the 'working up' process. The person responsible for this task is called the 'worker up'.

Table 10.4 illustrates how the items in the 'taking off' are marked off. A vertical line must be drawn through each description once you have transferred the item and the quantity applicable to it.

The same procedure must be followed for every item until all the items are transferred to the correct trade on the abstract sheets. Each sheet must clearly indicate with a 'tick' when all the items on a sheet were transferred.

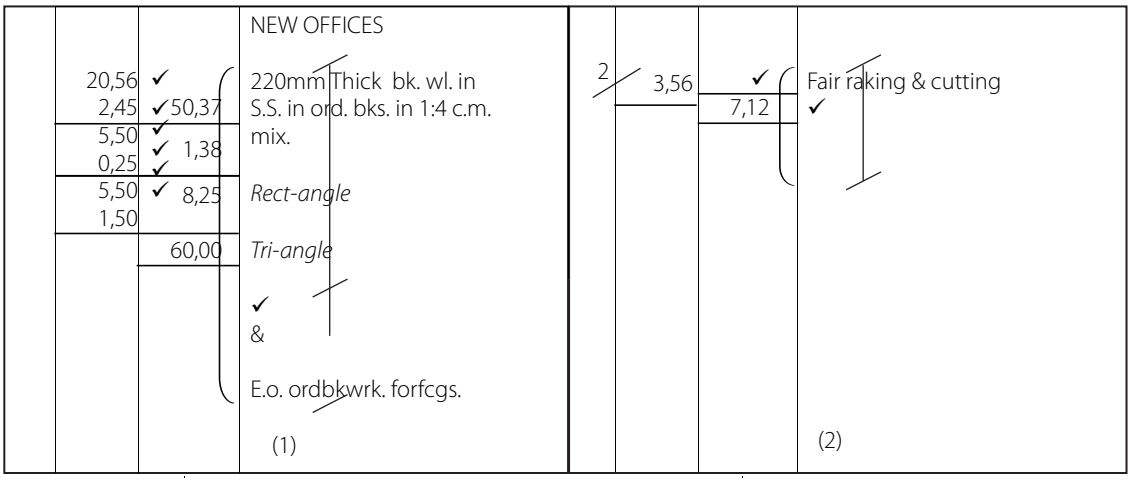


Table 10.4

The transferring process will have to be checked by another person who in turn will draw another vertical line through the same items, but in a different ink colour.

Table 10.5 will show what the abstract sheet looks like and how it must be used. The important information that needs to be provided on the abstract sheet is the following;

- The section work
- The unit of the item
- The trade
- The reduced amount

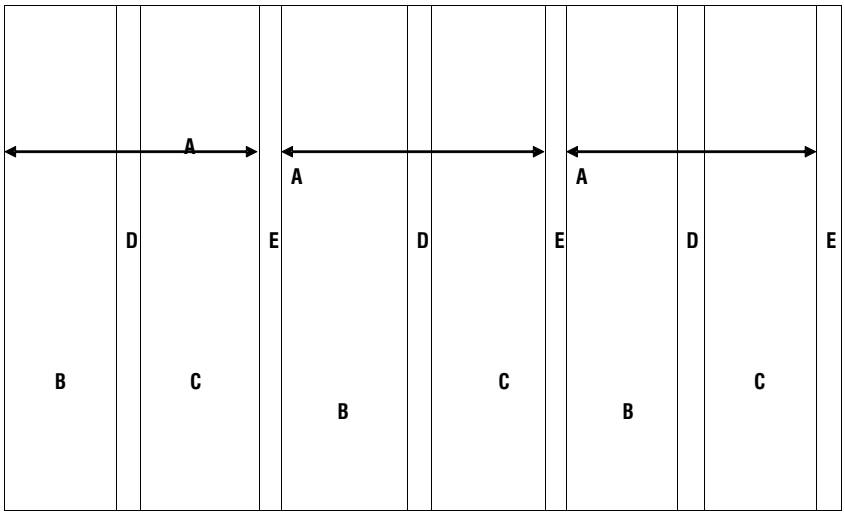


Table 10.5

A The arrow indicates the space where the items are to be written.
B This is the column in which all the positive quantities are to be written.
C This is the column in which all the negative quantities are to be written.
D This is the column in which the positive page numbers are written.
C This is the column in which the negative page numbers are written.

Table 10.6 overleaf, shows how the information that is transferred from the 'taking off', is to be written up on the abstract sheet.

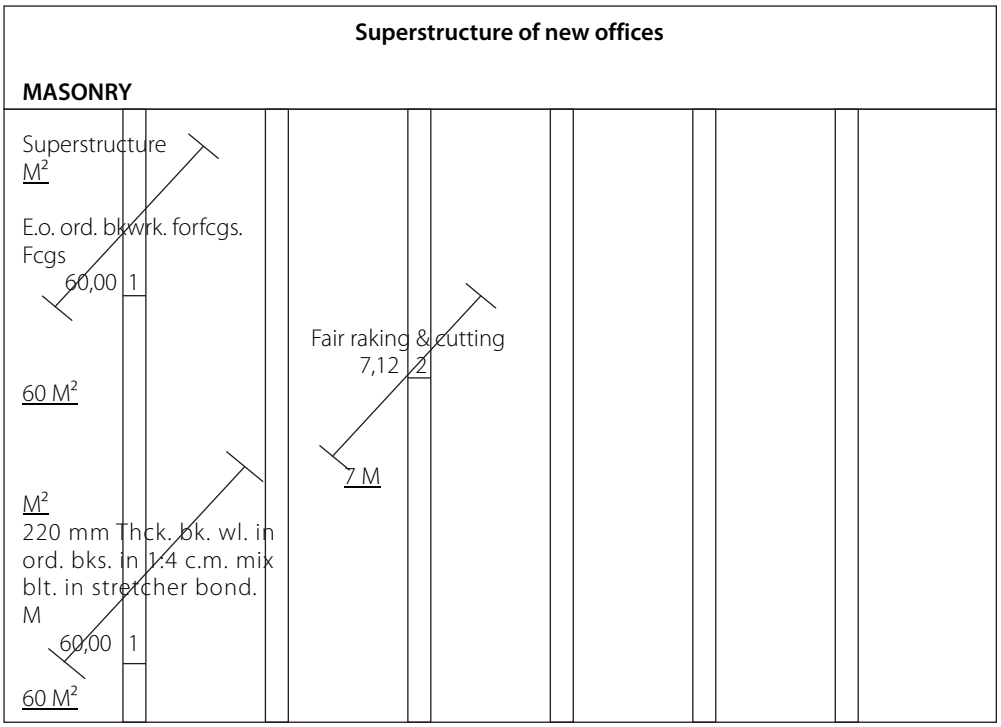


Table 10.6

You will notice that the items are written on the abstract in the same order as indicated in the Standard System. If for instance a cubic meter item was measured, it would have preceded the square meter items.

Note:
The items are written up in staggered formation.

All the quantities are positive, therefore no quantities will appear in the negative column. The item description and the reduced quantity will now be transferred to the bill paper sheet.

10.5 Billing

The bills of quantities will form part of the documentation of a legally enforced contract. It is therefore very important that the quantity surveyor pays special attention to its presentation.

The following basic principles when preparing a bills of quantities must be followed:

(i) The rules and requirements as laid down by the Standard System of measuring builder's work must be adhered to.
(ii) Descriptions must be clear, concise, unambiguous and fully written out as far as possible.
(iii) The various descriptions should be consistent both in their wording and the order in which details and sizes are given.
(iv) Good grammar and punctuation are essential; descriptions should be as brief as possible and repetitive wording should be avoided.
(v) Use the term 'ditto' carefully, to rule out wrong interpretations.

Table 10.7 shows a typical bill sheet, how it must be used and all the information required on it. As the items are transferred to the bill sheet, a diagonal line is used to cross out the item and quantities on the abstract sheet.

These transfers will be checked by a 'checker' who will in turn draw another diagonal line across the first diagonal line, but he will use a different colour. The written up draft bills of quantities will now be edited to sort out any errors before it will be presented in typed form.

Superstructure of new offices				
	Bill no.1 MASONRY Brickwork			
1	220mm Thick brick wall in ordinary bricks in 1:4 Cement mortar mix, built in stretcher bond.	M^2	60	
	Face bricks			
2	Extra over ordinary bricks for facings.	M^2	60	
3	Fair raking and cutting.	M	7	
	Carried to summary			R

Table 10.7

Before the typed 'original' sheets of the bills of quantities go through for photocopying or printing, a proof- reader checks them against the hand-written draft bills, to ensure that no typing errors were made.

Note:

(i) Each page of the bills of quantities should have a page summary that will be carried forward to a trade summary page. The summary of each trade will then be carried forward to a final summary page at the back of the bills of quantities.

(ii) Any numbering method may be used depending on system in use.

(ii) Do not use any of the abbreviations used during the 'taking off' or 'abstracting' stages, in the bills of quantities. The bills of quantities must be reader friendly and the meaning of some of these abbreviations might not be known to them.

Activity 10.1

1. What does the term 'squaring' mean?
2. What steps should be followed when 'squaring'?

Self Check

I am able to: **YES** **NO**

- Demonstrate the term 'squaring' & the steps that must be followed. ○ ○

If you have answered 'no' to any of the outcomes listed above, then speak to your facilitator for guidance and further development.

Notes

Past Examination Papers

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

APRIL 2013

NATIONAL CERTIFICATE

QUANTITY SURVEYING N5

(2050015)

5 April 2013 (X-Paper)
09:00 – 13:00

REQUIREMENTS: **Dimension paper (BOE 8/12)**
Abstract paper (BOE 8/10)
Billing paper (BOE 8/11)

Candidates may use their own unmarked STANDARD SYSTEM OF MEASURING BUILDING WORK.
Calculators may be used.

This question paper consists of 6 pages and 3 addenda.

TIME: 4 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Use only BLUE or BLACK ink.
5. ALL the work in SECTION A must be done on the appropriate paper.
6. ALL the work in SECTION B must be done in the ANSWER BOOK.
7. Write neatly and legibly

SECTION A

ADDENDUM B (attached), shows the front view of a timber door frame with a three glass panel fixed on both sides of the door opening and view of section 8-B.
ADDENDUM C (attached) shows views of sections A-A and C-C.

SPECIFICATIONS:

CONCRETE:	15 MPa and 100 mm surface bed
MASONRY:	Ordinary brickwork Face brickwork externally 114 x 75 mm prefabricated lintel
CARPENTRY AND JOINERY:	2 032 x 813 x 44 mm meranti three-panelled door 110 x 76 mm solid meranti door frame
PLASTERING:	19 mm thick plaster internally 25 mm thick cement mortar screed
FLOOR COVERING:	Vinyl floor tiles
IRONMONGERY:	100 x 45 mm brass butt hinges Three-lever mortise door lock and furniture Stainless steel door anchors (three both sides of the frame) 40 mm weather bar
PAINTING:	TWO coats clear varnish on ALL exposed timber surfaces Prime coat to backs of the frame TWO coats PVA paint to plaster surfaces

ALL the work in SECTION A must be done on dimension, abstract and billing paper.

QUESTION 1

Measure the items regarding the door using the measuring list below.

1.1 Measure the items regarding the door using the measuring list below.
The timber door (2)

1.2 Varnish to timber surfaces (4)

1.3 Mortise lock (2)

1.4 Brass hinges (2)

[10]

QUESTION 2

Measure the items regarding the door frame using the measuring list below.

2.1 The solid timber door frame (8)

2.2 Prime backs of frame (3)

2.3 Varnish the exposed areas of the frame (7)

2.4 Stainless steel anchors (2)

2.5 Weather bar (2)

2.6 Damp proofing around the frame (3)

2.7 Glazing (5)

[30]

QUESTION 3

Measure ALL the items for the adjustments to the internal and external finishes using the measuring list below.

DEDUCT:

3.1 The 220 mm brick wall (5)

3.2 The external face brickwork (4)

3.3 The internal plaster and paint (6)

ADD:

3.4 The finishes to the reveals (7)

3.5 The concrete lintels in the head (3)

3.6 The concrete and vinyl floor tiles in the threshold (5)

[30]

QUESTION 4

Draw up a tender document for the ironmongery trade only.

4.1 Do the squaring for QUESTION 1 and QUESTION 2. (6)

4.2 Abstract only the ironmongery items. (7)

4.3 Bill the ironmongery items only. (7)

[20]

TOTAL SECTION A: 90

SECTION B

ALL the work in SECTION 8 must be done in the ANSWER BOOK.

QUESTION 5

Prepare the final account for the shopping centre and calculate the final payment due to the contractor based on the relevant items in the summary of the bills of quantities as set out on ADDENDUM A (attached).

The following adjustments need to be made:

- Prime cost and provisional sums must be adjusted to R150 500,00
- Net extra on variation orders to be R37 678,00
- Remeasurement of foundations R95 778,89
- Remeasurement of plumbing and drainage R112 567,99
- Remeasurement of site works R 129 456,96
- Increased cost amount to R95 785,45
- Payments previously received amount to R 1 106 345,00 **[15]**

QUESTION 6

Contingencies is the term used in the bills of quantities to make provision for changes to the original contract. Explain the steps to be taken to establish the financial implication for each of the following variation orders:

6.1 The client requests that work already executed be demolished and replaced by new work (5)

6.2 The client requests that work that is not related to measured work in the original bills of quantities be executed. This results in extension of the contract period (5)

6.3 'Day works' (5)

[15]

QUESTION 7

A professional quantity surveyor provides various services to a client. Name FIVE services provided during each of the following periods:

7.1 Pre-contract period (5)

7.2 Post -contract period (5)

[10]

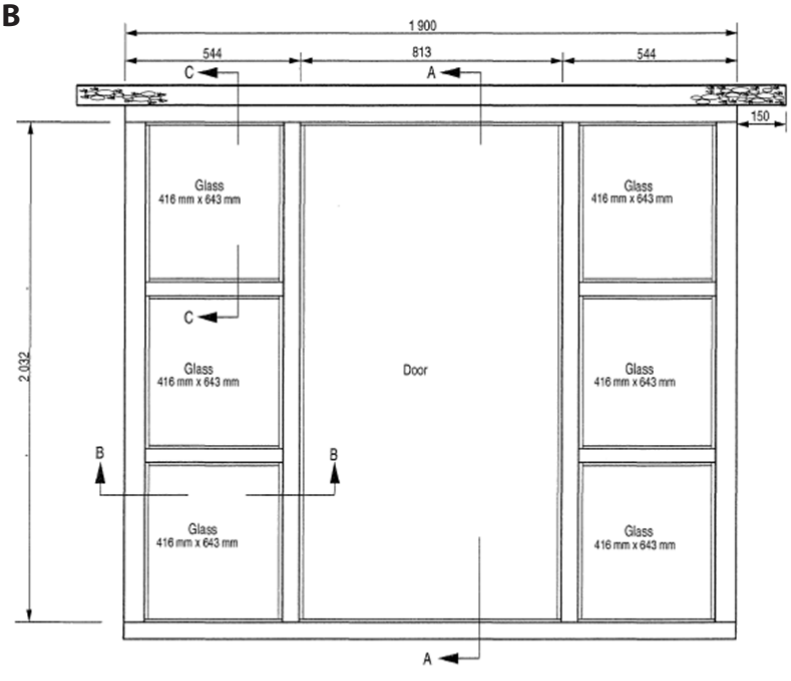
TOTAL SECTION B:40
GRAND TOTAL130

ADDENDUM A

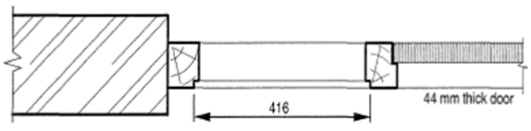
SHOPPING CENTRE
FINAL SUMMARY PAGE

Bill No.	Description	Page	Amount
1.	Preliminary & General	80	R88 575,00
2.	Earthworks	96	R121 241,33
3.	Concrete, Formwork & Reinforcement	100	R90 500,25
4.	Masonry	112	R126 667,84
5.	Waterproofing	115	R10 345,99
6.	Carpentry & Joinery	123	R77 546,00
7.	Floor Coverings	154	R49 699,98
8.	Ironmongery	168	R6 700,00
9.	Metalwork	168	R72 678,78
10.	Plastering	175	R45 765,00
11.	Tiling	185	R4 587,00
12.	Plumbing & Drainage	190	R89 692,99
13.	Glazing	198	R45 034,99
14.	Painting	203	R23 435,87
15.	Site Works	213	R132 435,96
16.	Prime Cost and Provisional Sums	220	R135 259,45
17.	Contingency Sum		R55 500,00
	FINAL TENDER PRICE		R 1 175 666143

ADDENDUM B

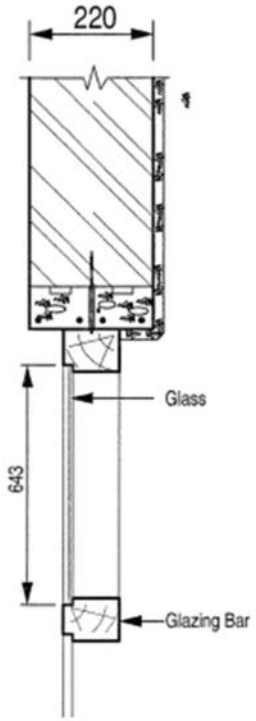


FRONT VIEW

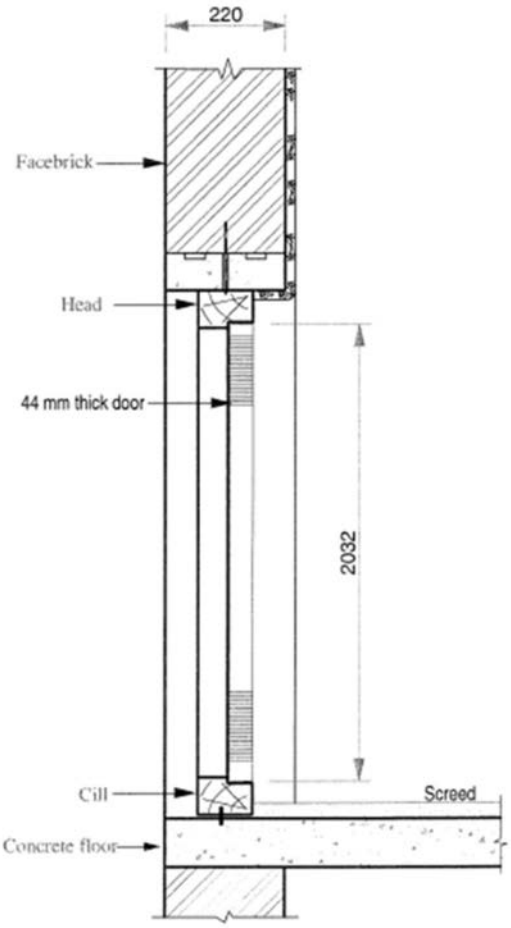


Section B-B

ADDENDUM C



Section C-C



Section A-A

Past Examination Papers

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NOVEMBER 2012

NATIONAL CERTIFICATE

QUANTITY SURVEYING N5

(2050015)

15 November 2013 (X-Paper)
09:00 – 13:00

REQUIREMENTS: **Dimension paper (BOE 8/12)**
Abstract paper (BOE 8/10)
Billing paper (BOE 8/11)

Candidates may use their own unmarked STANDARD SYSTEM OF MEASURING BUILDING WORK.
Calculators may be used.

This question paper consists of 5 pages and 2 annexures.

TIME: 4 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Use only BLUE or BLACK ink.
5. ALL the work in SECTION A must be done on the appropriate paper.
6. ALL the work in SECTION B must be done in the ANSWER BOOK.
7. Write neatly and legibly

SECTION A

On ANNEXURE A (attached) the floor plan and sectional views of a mountain hut are shown. The specifications for the different traders are as follows:

SPECIFICATIONS:

Earthworks: - Excavation is in ordinary earth
Concrete: - 15 MPa
Masonry: - Ordinary bricks built in stretcher bond
- Facebrick externally
- 1 :4 cement mortar

NOTE: Use dimension paper to answer QUESTIONS 1 - 3.

QUESTION 1

Calculate the following:

1.1 The length of the external perimeter of the hut (4)

1.2 The centre line of the external 330 mm foundation wall (3)

1.3 The centre line of the internal 330 mm foundation wall (5)

1.4 The height of the risk of collapse (2)

1.5 Determine the height of the 330 mm foundation wall (1)

[15]

QUESTION 2

Use the dimensions calculated in QUESTION 1 above to measure the following:

2.1 Excavate for surface trenches excluding water and carting away of surplus material (3)

2.2 Passing for excavation of surface trenches (4)

2.3 Risk of collapse in ALL the foundation trenches (3)

2.4 Passing for risk of collapse (4)

[14]

QUESTION 3

Measure the following:

3.1 330 mm thick foundation wall (3)

3.2 Mass concrete in footings (3)

3.3 Passing for concrete in footings (3)

3.4 Backfilling in trenches(3)

3.5 Passing for backfilling in trenches(4)

[16]

QUESTION 4

Refer to the answers in QUESTION 2 and QUESTION 3 and do only the following:

4.1 Square only the earthwork (4)

4.2 Abstract ALL the earthwork items (5)

4.3 Bill ALL the earthwork items (6)

[15]
TOTAL SECTION A: 60

SECTION B
Use the ANSWER BOOK to answer the questions in this section.

QUESTION 5
Prepare the interim valuation for the fourth partial payment to the contractor.
ALL calculated amounts to be rounded off to the nearest 1 0 rand.
The summary of the bill of quantities is shown on the attached ANNEXURE B.

- The contract period is 9 months
- 1 00°/o of the earthwork is complete
- 1 00°/o of the concrete work is complete
- 85°/o of the masonry is complete
- 1 0°/o of the waterproofing is complete
- 15°/o of the carpentry and joinery is complete
- The value of unfixed material on site is R6 500,00
- A retention fee of 1 0°/o is withheld to a maximum of 5°/o contract value
- The contractor was paid a total amount of R682 350,00 for the first three months. **[10]**

QUESTION 6
6.1 State the principles laid down by the Standard System how the following should be measured:

6.1.1 Stripping of topsoil (3)

6.1.2 Open face excavations (4)

6.2 Explain the following terms:

6.2.1 Nominated suppliers (4)

6.2.2 Nominated sub-contractors (4)

[15]

QUESTION 7
Consult the Standard System and in your own words, state how the following items should be measured:

7.1 Face-brick in reveals (3)

7.2 Paint reveals not wider than 300 mm (3)

7.3 Plaster in narrow widths not wider than 300 mm (3)

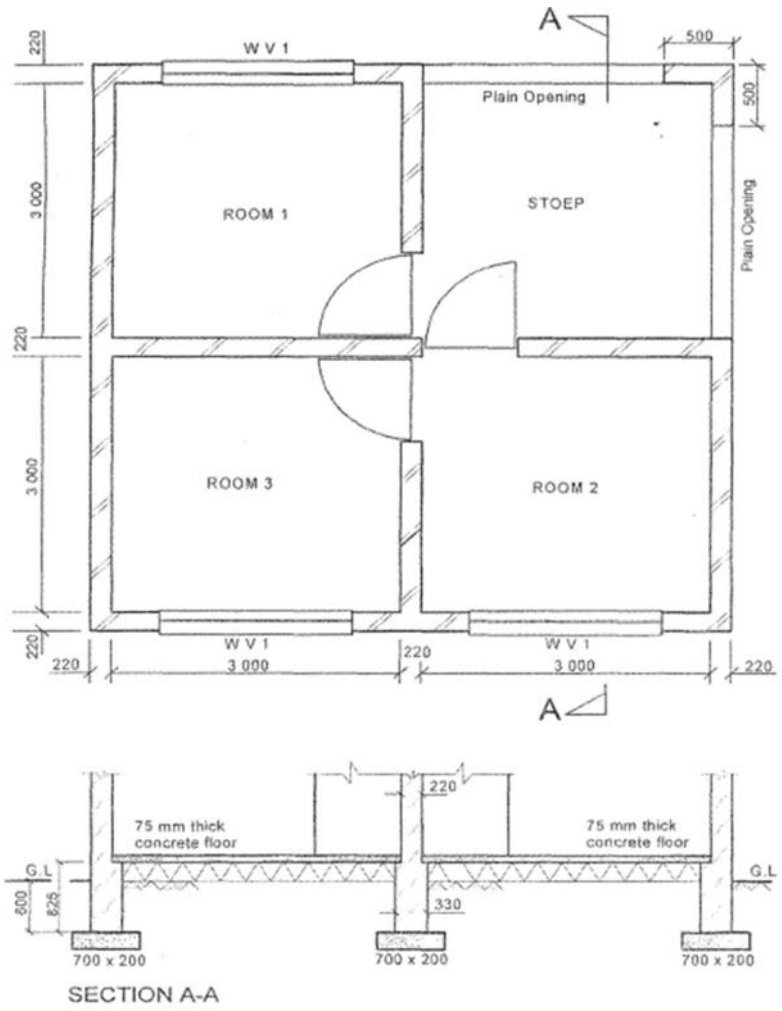
7.4 Pre-cast concrete lintels (3)

7.5 Paint on steel windows (3)

[15]

TOTAL SECTION B:40
GRAND TOTAL100

ANNEXURE A



SECTION A-A

ANNEXURE B

BILLS OF QUANTITIES

1.	Preliminary & general	R 125 300,00
2.	Earthworks	R 99 510,00
3.	Concrete, Formwork & Steel Reinforcement	R 457 678,00
4.	Masonry R 220 300,00	
5.	Waterproofing	R 17 453,00
6.	Roof coverings	R 205 321,00
7.	Carpentry & Joinery	R 67 423,00
8.	Ceilings	R 25 308,00
9.	Floor coverings	R 41 523,00
10.	Ironmongery	R 6 789,00
11.	Metalwork	R 42 834,00
12.	Plastering	R 20 318,00
13.	Plumbing & Drainage	R 45 756,00
14.	Glazing	R 15 909,00
15.	Painting	R 45 778,00
16.	Contingency Sum	R 62 155,00
		R1 492 375,00

Past Examination Papers

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

APRIL 2012

NATIONAL CERTIFICATE

QUANTITY SURVEYING N5

(2050015)

15 November 2013 (X-Paper)
09:00 – 13:00

REQUIREMENTS:

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TIME: 4 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

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2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Use only BLUE or BLACK ink.
5. ALL the work in SECTION A must be done on the appropriate paper.
6. ALL the work in SECTION B must be done in the ANSWER BOOK.
7. Write neatly and legibly

SECTION A

Use only dimension, abstract and billing paper to answer the questions in SECTION A.

ANNEXURE B shows the front view and sectional details of a solid three-panelled timber door and frame built into a 270 mm thick external cavity wall.

SPECIFICATIONS:

Concrete	- 25 MPa
Brickwork	- Ordinary brickwork built in stretcher bond - 1:4 cement mortar - Facing bricks externally
Floor covering:	- Vinyl tiles to floors
Carpentry and joinery:	- All timbers to be meranti timber - 75 x 19 mm Timber skirting internally - 2 032 x 813 x 44 mm Three-panelled door - 114 x 76 mm solid timber door frame
Ironmongery:	- 3 No 100 x 75 mm Brass steel hinges - 1 No 3 lever door lock and furniture
Plastering:	- 19 mm thick internal plaster - 30 mm thick floor screed
Painting:	- Two coats clear varnish to all timber surfaces - PVA paint to plastered walls

QUESTION 1

Measure the work to be done strictly to the following measuring list:

1.1	Door	(2)
1.2	Paint to door	(5)
1.3	Ironmongery	(4)
1.4	Door frame	(6)
1.5	Paint to door frame	(2)
		[20]

QUESTION 2

Measure the adjustments to the external and internal finishes according to the following measuring list:

2.1	270 mm thick cavity wall.	(3)
2.2	External facings and facings to reveals and head.	(4)
2.3	Internal plaster and paint and plaster and paint to reveals and head.	(9)
2.4	Concrete in threshold.	(2)
2.5	Build cavities solid.	(2)
		[20]

QUESTION 3
You are required to present a bill for the Carpentry & Joinery trade only.

3.1 Do the squaring exercise (5)

3.2 Do the abstracting exercise (7)

3.3 Draw up the bill (8)

[20]

TOTAL SECTION A: 60

SECTION B
Use the answer book to answer the questions in SECTION B.

QUESTION 4: QUANTITY SURVEYING TERMS
Give ONE word/term for each of the following descriptions by choosing a word/term from the list below. Write only the word/term next to the question number (4.1 - 4.1 0) in the ANSWER BOOK.

ditto; purpose made; nett measurement; practical completion; contingencies; interim valuations; interim payment certificate; extra labour and material; preambles; primary cost amount; provisional amounts; specifications; escalations

4.1 A reasonable budget estimate of the total value of the works satisfactorily executed.

4.2 A lump sum included in the tender to cover any costs of unforeseen items which may occur during the execution of the project.

4.3 Term used to describe work over and above some items already allowed for in the bills of quantities.

4.4 Term used to save repeating long and similar descriptions in writing.

4.5 The certificate issued by the Architect indicating the amount due and payable by the client to the contractor.

4.6 The term used to specify that the measurement for any item excludes extras, waste and laps.

4.7 An item which must be specially manufactured for a project.

4.8 A brief specification on workmanship and quality of materials under each trade.

4.9 A sum of money provided in the bills of quantities for materials and goods to be obtained from a supplier nominated by the Architect

4.10 An amount allowed in the bills of quantities to provide for specialist work to be carried out by a specialist sub-contractor selected by the Architect

[10]

QUESTION 5: QUANTITY SURVEYING DUTIES

5.1 State FIVE duties of a quantity surveyor during the pre-contract period. (5)

5.2 State FIVE duties of a quantity surveyor during the post-contract period. (5)

[10]

QUESTION 6: INTERIM VALUATIONS

Consult the summary of a bills of quantities shown in ANNEXURE A (attached) and prepare the first partial payment to the contractor based on the following information:

- The contract period is TEN months
- All the earthwork is complete
- 20% of the concrete work is complete
- 10 % of the masonry is complete
- A further R6 000,00 for plumbing and drainage pipes is allowed
- The value of the unfixed material on site is R7 000,00
- Allow for a 10 % for the retention fund
- Round off all calculated amounts to the nearest TEN rand (R10).

[10]

QUESTION 7: THE STANDARD SYSTEM

Consult your Standard System for Measuring Building Work and extract only the TRADE and UNITS to which the following should be measured:

7.1 Tree stumps. (2)

7.2 Surplus excavation material. (2)

7.3 Working space. (2)

7.4 Plate-nailed trusses. (2)

7.5 Ceilings. (2)

[10]
TOTAL SECTION B: 40
GRAND TOTAL: 100

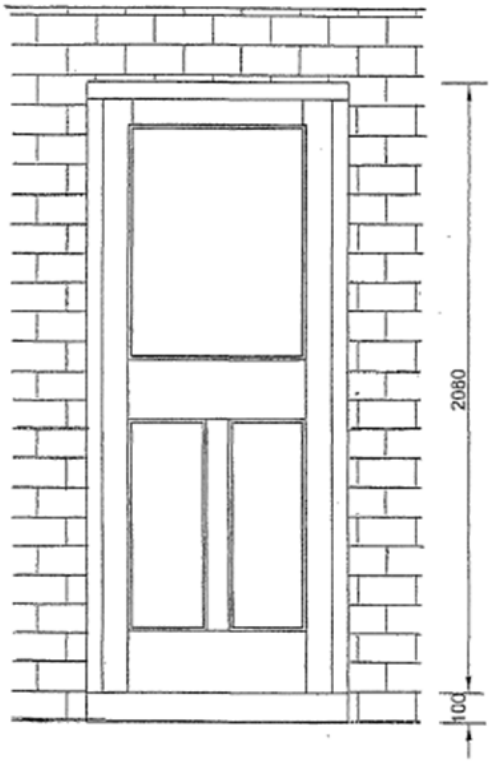
ANNEXURE A

BILLS OF QUANTITIES

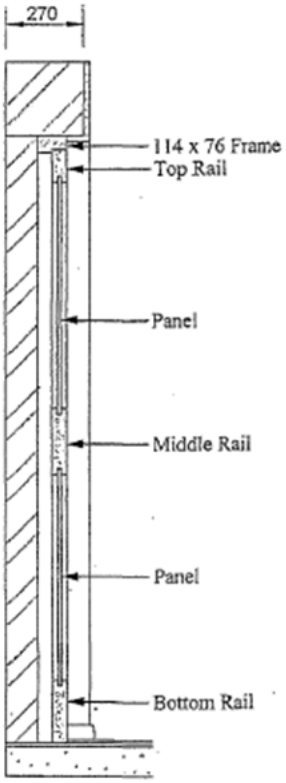
SUMMARY

1.	Preliminaries	R 250 000,00
2.	Earthworks	R 95 600,00
3.	Concrete, Formwork & Reinforcement	R 430 300,00
4.	Masonry	R 175 000,00
5.	Waterproofing	R 17 300,00
6.	Roof covering	R 80 220,00
7.	Carpentry & joinery	R 75 500,00
8.	Ceilings	R 30 300,00
9.	Floor coverings	R 40 300,00
10.	Ironmongery	R 5 200,00
11.	Metalwork	R 36 500,00
12.	Plastering	R 36 300,00
13.	Plumbing & drainage	R 75 000,00
14.	Glazing	R 15 300,00
15.	Painting	R 45 500,00
16.	External works	R 60 300,00
		R1 488 620,00

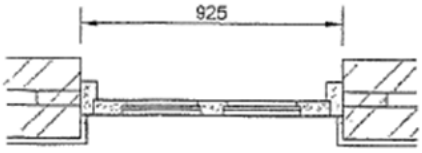
ANNEXURE B



Front View



Vertical Section



Horizontal Section

Notes

Quantity Surveying N5 is one of many publications introducing the gateways to Engineering Studies. This course is designed to develop the skills for learners that are studying toward an artisanship in the building and civil construction fields and to assist them to achieve their full potential in an civil engineering career.

This book, with its modular competence-based approach, is aimed at assisting facilitators and learners alike. With its comprehensive understanding of the engineering environment, it assists them to achieve the outcomes set for course.

The subject matter is presented as worked examples in the problem-solving-result methodology sequence, supported by numerous and clear illustrations.

Practical activities are included throughout the book.

The authors are well known and respected in the building and civil construction fields. Their extensive experience gives an excellent base for further study, as well as a broad understanding of civil technology and the knowledge to success.

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- N2 Bricklaying and Plastering Theory

- N1 Woodworkers Theory
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- N3 Building and Civil Technology

- N4 Quantity Surveying
- N5 Quantity Surveying
- N6 Quantity Surveying

- N4 Building and Structural Surveying
- N5 Building and Structural Surveying
- N6 Building and Structural Surveying

- N4 Building Administration
- N5 Building Administration
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- N4 Building and Structural Construction
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Published by
Hybrid Learning Solutions (Pty) Ltd
4 Golf Park Building
Mowbray
Tel: 021 460 4488
Email: orders@hybridlearning.co.za

7 781928 203735