

4. Measurement of Different Works

The general approach to measurement will require the separation of works between substructure and superstructure.

The terms 'substructure' and 'superstructure' describe all structural works below and above ground level respectively. The substructure is likely to include:

- Ground work
- Concrete work
- Masonry work

The superstructure most likely includes:

- Concrete work
- Masonry work
- Roofing
- Carpentry and joinery
- Metal work
- Finishing
- Glazing
- Sanitary installation
- Electrical installation

The demarcation between the substructure and superstructure should be taken as the *damp proof course* in structural walls. The ground floor slab would be measured with substructure work.

4.1 Groundwork

Site Preparation/Over site Excavation

It includes removal of trees and tree stumps, and clearing site vegetation.

Removal of trees and tree stumps is measured as enumerated item. Tree girths are measured at a height of 1.00m above ground and stump girths at the top.

Clearing site vegetation is measured in m² and embraces bushes, scrub, undergrowth, hedges, trees and tree stumps ≤ 600 mm.

Excavation

It includes the following items:

- Topsoil excavation
- Excavation to reduce levels

- Excavation for foundation/ Deep excavation
- Backfilling
- Disposal of excavated material

Topsoil Excavation

The surface of most 'green field' sites comprises a compactable layer of vegetable matter called 'topsoil'. It is measured in m^2 stating the average topsoil depth in the description. A clearance around the entire basic plan must be left, usually about 1.0-1.5m is allowed on each side of a building.

Disposal of this material off the site is measured in m^3 , giving details of specified locations and handling where appropriate.

Excavation to Reduce Levels

Where the site is sloping then further excavation is required to reduce the level of the ground to the specified formation level; this excavation is measured in m^3 , giving the maximum depth range in the description.

Deep Excavation

It is the actual excavation for the foundation and is measured in m^3 . All excavation is measured net with no allowance for increasing in bulk after excavation.

Backfilling

Once the foundation of the building is constructed, one of the next steps in construction is the backfilling. It is the put back of soil that is removed during the deep excavation or selected material from somewhere else.

Disposal of Excavated Materials

Removing excavated material from the site often costs more than the initial excavation. For this reason it is always necessary to measure disposal of excavated materials as a separate item in m^3 . It is necessary to describe where and how the material is to be transported.

4.2 Masonry work

The measurement of masonry work requires the separation between substructure and superstructure.

With some exception, the principal unit of measurement for masonry work is m^2 . The two dimensions needed to provide this area are the centerline length and the height of the walling. The description will identify the walling thickness, the type of masonry unit, the bond, the type of mortar and the pointing. Rather than repeating these details in every

description, a heading can be established to include the majority of this information. The subsequent descriptions need only make reference to the wall's thickness and whether it is face work on one or both sides.

64.00 3.00		20 cm thick hollow block for the external wall bedded in cement- sand mortar with mix ratio (1:3)
	45.00	
16.00 1.00		Ditto but for the 10 cm thick parapet wall
	16.00	
15.00 3.00		Ditto but for the 15 cm thick internal wall
	45.00	

The majority of cavity or hollow walls are constructed with an outer leaf in brickwork, a cavity, which may or may not be insulated, and an inner leaf of block work. Each of these layers will require measuring as a separate item and each will require a separate waste calculation in order to determine its center line length. If the cavity includes any rigid sheet insulation, this can be incorporated as part of the description of forming cavities, stating type, thickness and method of fixing.

The normal order of measurement is:

1. External walls
2. Internal walls
3. Chimney breasts and stacks

External walls

The length of external walling will be obtained by the method of girthing and the height will normally be taken up to some convenient level, such as the general eaves line. Any additional areas of external wall, such as gables, parapets and the like will be then taken off. Finally, adjustment of walling for windows and door openings will be made.

Internal walls

The measurement of external walls is usually followed by internal walls, which may be of bricks or blocks. A careful check should be made on the type and thickness of each partition.

4.3 Concrete Work

The Measurement of concrete work comprises the measurement of the concrete (Plain concrete) and the reinforcement bars. The order of measurement is:

- Concrete
- Reinforcement bars

The unit of measurement for the concrete is m^3 . The descriptive part of the measurement identifies the type (characteristic compressive strength), the mix proportion, and the work for the placement and compaction.

The steel bars are measured in kg. Quantities are taken from the structural drawing and recorded on specially lined paper known as bar schedule.

Bar schedule

Bar mark	ϕ (mm)	Shape of bending (Dimensions in cm)	Length (m)	No.	Total length (m)	Weight (kg)

Linear density for the determination of the quantity of bars (kg)

ϕ (mm)	6.0	8.0	10.0	12.0	14.0	16.0	20.0	22.0	25.0	28.0	32.0	36.0
Density (Kg/m)	0.22	0.39	0.62	0.89	1.21	1.58	2.47	2.98	3.85	4.85	6.31	7.99

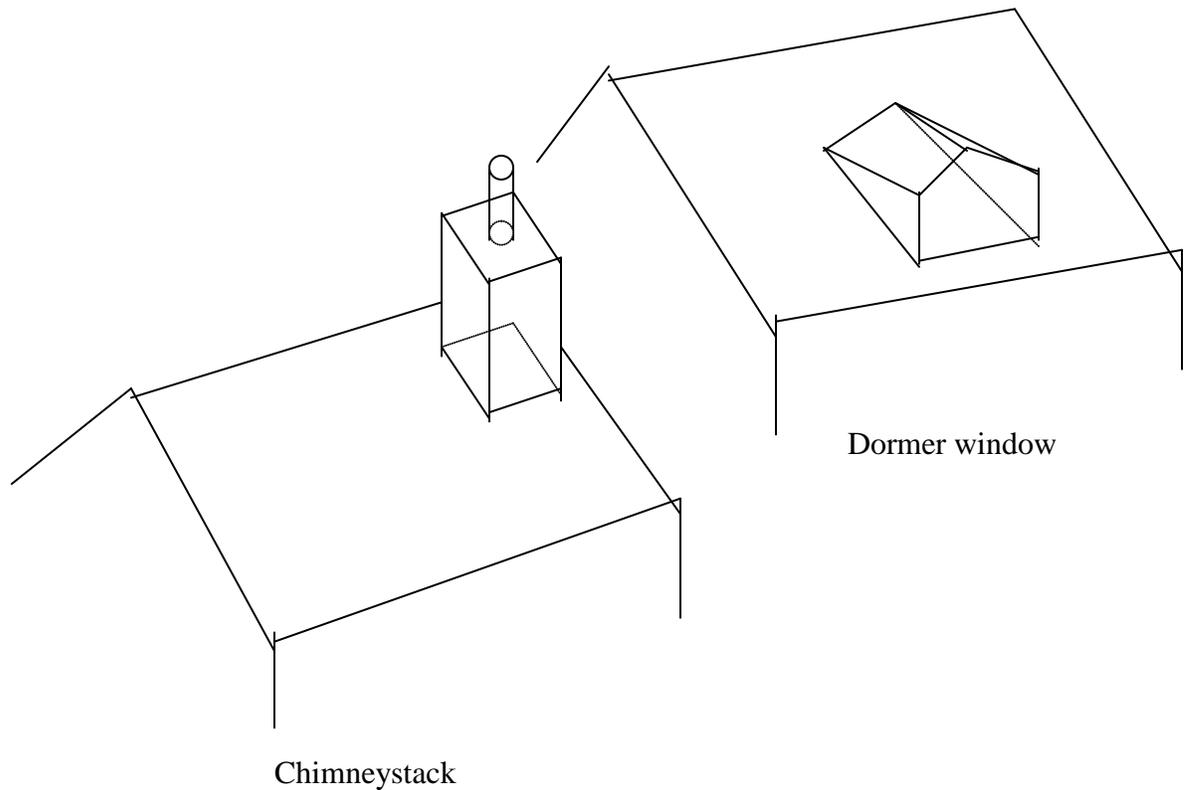
4.4 Measurement of Roofs

Introduction

The measurement of pitched and flat roofs conveniently divides between the roof structure and the roof covering. In practice the measurement of roof coverings will follow the measurement of the roof structure. Eave and barge boarding together with guttering and down pipes are normally included as part of the measurement of roof coverings.

The principal unit of measurement for roof coverings is m^2 . The descriptive part of the measurement must identify the kind, quality and size of materials, together with the method of fixing. The measurement of the main roof slope area should be followed by adjustments for chimneys and dormers. No adjustment is made to the roof covering area for voids of less than one square meter in area.

Ridges, hips, valleys, eaves and the like are all measured in linear meters.



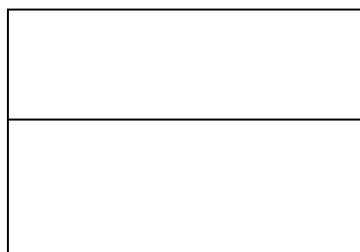
Measurement of Roof Structure

The Unit of measurement for roof structure naturally falls between enumerated items (trusses) and linear meters, (rafters and purlins). In the case of the latter the description must include the cross sectional dimensions of the material being used; whilst the former must fully describe the truss.

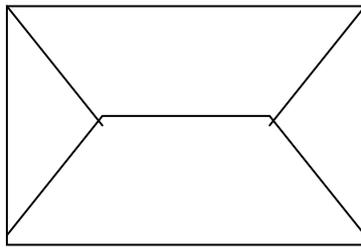
Measurement of Pitched Roof Coverings

The area of roof coverings is unaffected by the inclusion of hipped ends and valleys so long as the roof pitch remains constant.

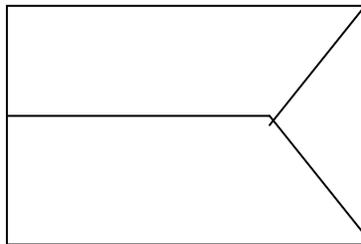
Illustration:



GABLED



HIPPED



COMBINATION OF HIPPED AND GABLED

When measured, all three will provide the same roof slope area, regardless of whether they are hipped, gabled or a combination of the two.

In each case the sloping roof area can be established by initially ignoring any projects, valleys or hips and simply measuring the main length (L) multiplied by the roof slope length (s). Some surveyors choose to enter the dimensions for the roof slope area by recording the plan area of the roof in the dimension column and timesing this by the natural secant of the roof slope in the timesing column. Others prefer to establish the roof slope length as a waste calculation first and then record the plan length and the roof slope length in the dimension column. This is then timesed by two for each roof slope in the timesing column.

Measurement of Flat Roof coverings

Measurement of flat roof coverings should follow the same pattern as pitched roof coverings, with the roof structure being measured first, followed by the covering.

Asphalt coverings to flat roofs are measured in m².

Fascia, eaves and verge boarding

Eaves soffit boarding (fascia and soffit) together with verge (barge) boards not exceeding 300 mm girth are measured in linear meters giving their size in the description. Where boards exceed 300 mm wide they may be measured superficially.

Rainwater gutters and down pipes

The measurement of rainwater goods completes the work associated with roof coverings. Gutters and down pipes are measured in linear meters over all fittings. The description should include reference to the type of pipe or gutter, its nominal size, and the type,

method and spacing of fixings. Fittings, such as running outlets, stopped ends, offsets and connecting shoes, are enumerated and measured extra over the pipe or gutter on which they occur.

4.5 Measurement of Finishings

The term 'Finishings' includes operations associated with the completion of the floors, walls and ceilings of a building. These are screeding, plastering, wall and floor tiling, wallpapering and painting.

Sequence of Measurement

In the measurement of this work, it is essential to adopt a logical order in taking off work. The order of measurement of finishings on each floor will normally be:

- Ceiling
- Walls
- Floors

Linear items like skirting will follow the measurement of the main areas of wall finishings.

General rules of measurement

Work to attached beams is included with ceiling finishes, whilst work to attached columns is included with wall finishes. Finishes to isolated beams and columns must be given separately as should work in staircase.

The principal unit of measurement for wall, floor and ceiling finishes is m². Where the width does not exceed 300 mm the unit of measurement is linear.

Ceiling Finishings

The ceiling area is measured in m² between wall surfaces, stating in the description the thickness and the number of coats. In cases where the ceiling finishes are identical throughout a floor, it may be appropriate to measure gross, over internal walls, and subsequently deduct the plan area of internal walls from the gross ceiling area.

Wall Finishings

The measurement of wall finishings is taken from floor to ceiling. The perimeter length of each room should be established as a waste calculation and then transferred to the dimension column where it is followed by the floor to ceiling height.

Where the wall finishings are of tiles, full particulars of the finishings are to be given, such as kind, quality and size of materials, and method of fixing.

Skirtings

Skirtings are measured in linear meters and usually included with the measurement of wall finishings. All are based on room girths and can be ampersanded to the dimensions established for wall plaster purposes (assuming the constant dimension approach is adopted).

Floor Finishings

Cement and sand screeds together with tiled or wood block floors are measured in m². In some situations it is possible to utilize the previously booked ceiling areas for the measurement of floors. The use of an ampersand to link these two sets of dimensions can save a great deal of time, but care should be taken to ensure the respective areas are consistent.

Painting

The unit of measurement for painting is based on the girth of the surface to be painted. Where it exceeds 300 mm it is measured as an area and where it is an isolated surface and does not exceed 300 mm in girth, it is measured in linear meters.

4.6 Measurement of Plumbing Installation

Plumbing installations in domestic buildings involve a number of different systems associated by the supply, distribution and disposal of water within and out of a building - above the ground and below the ground.

Order of Measurement

1. Connection to water authority's main and all work up to boundary of site
2. Underground service and rising main from site boundary up to cold water storage tank
3. Branches to rising main
4. Cold water storage tank or cistern and associated work
5. Down services with branches
6. Sanitary appliances such as sinks, wash basins, baths and water closets
7. Discharge pipes – waste, soil and vent pipes
8. Any other work connected with the plumbing installation

The order is following the flow of water as it enters and is distributed around the building, and collected after being used.

Pipe work

Pipes are measured in linear meters over all fittings and branches, stating the type, nominal size and the method of jointing and fixing.

Fittings are enumerated and measured as extra-over the pipe work on which they occur.

Equipments

In a domestic situation this will include such things as boilers, pumps, cisterns and cylinders. These are enumerated giving in the description the type, size, pattern, rated duty, capacity and method of fixing.

Sanitary Appliances

This includes washbasins, urinals, baths, bidets, shower trays and sinks. These appliances are enumerated giving details in the description of their type, size, capacity and method of fixing.

Waste pipe work

It embraces all the pipe work and fittings that are associated with the disposal of used or soiled water, and vent pipe. The following diameters of pipe are required for the different appliances:

Washbasin ----- 32 mm dia.
Bath/shower/sink ----- 40 mm dia.
Water closet (WC) ----- 110 mm dia.

Waste pipe work is measured in linear meters, giving in the description details of the type of the pipe, its nominal size, the method of jointing and the type of pipe brackets.

Fittings – elbows, tees and the like – are enumerated as extra-over the pipe work on which they occur.

Drainage work

It is the disposal of used and surface water from a building to a point of disposal or treatment.

Drains include excavation of pipe trenches, drain pipes and fittings. Pipes are measured over all fittings and branches in linear meters, stating the kind of pipe work, the nominal size and the method of jointing. Pipefittings, such as bends and branches, are enumerated extra-over the pipe on which they occur.

The excavation, concrete work, brickwork and rendering associated with manholes and septic tanks are measured in accordance with the rules for the appropriate work section.

4.7 Measurement of Electrical Installation

Electricity can only be transmitted through a conductor when there is a complete circuit from the source, via a conductor, back to the source. Each conductor cable contains a

‘live’ wire carrying the power to an appliance, a ‘neutral’ wire carrying the power back to the source and an earth wire which reduces the risk of shock by carrying the current to a circuit breaker or the ground in the event of a short-circuit. The conductor used for the domestic supplies is copper wire.

Cables are identified by the cross sectional area of the conductors and this is expressed in mm². The more common cable sizes and the number of wiring circuits found in domestic wiring installations are given below.

Cable Size (mm ²)	Wiring Circuits	No. of wiring Circuits
1.00 or 1.50	Lighting Circuits	One per floor
2.5	Power Circuits	One per floor
2.50	Immersion heater	Single circuit per appliance
10.00	Cooker	Single circuit per appliance
10.00	Spontaneous shower	Single circuit per appliance

Cabling

Conduit and cable are each measured separately in linear meters stating in the description the type and size of cabling.

Switches, Socket outlets and Light Points

As a separate enumerated item socket outlets, light points (luminaries) and other accessories should be enumerated.

Appliances

Separately fused circuits will be necessary for the cooker, immersion heater and electric heating units, and are enumerated items.