

**Department of Civil Engineering  
National Institute of Technology Srinagar**

**Topic: Works Estimate**

**RULES FOR MEASUREMENT :**

The rules for measurement of each item are invariably described in IS-1200. However some of the general rules are listed below.

1. Measurement shall be made for finished item of work and description of each item shall include materials, transport, labour, fabrication tools and plant and all types of overheads for finishing the work in required shape, size and specification.
2. In booking, the order shall be in sequence of length, breadth and height or thickness.
3. All works shall be measured subject to the following tolerances.
  - i) Linear measurement shall be measured to the nearest 0.01m.
  - ii) Areas shall be measured to the nearest 0.01 sq. m
  - iii) Cubic contents shall be worked-out to the nearest 0.01 cum
4. Same type of work under different conditions and nature shall be measured separately under separate items.
5. The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.
6. In case of masonry (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described:
  - a) From foundation to plinth level
  - b) From plinth level to First floor level
  - c) From First floor to Second floor level and so on.

**METHODS OF TAKING OUT QUANTITIES:**

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., can be worked out by any of the following two methods:

- a) Long wall - short wall method
- b) Centre line method.
- c) Partly centre line and short wall method.

**a) Long wall-short wall method:**

In this method, the wall along the length of room is considered to be long wall while the wall perpendicular to long wall is said to be short wall. To get the length of long wall or short wall, calculate first the centre line lengths of individual walls. Then the length of long wall, (out to out) may be calculated after adding half breadth at each end to its centre line length. Thus the length of short wall measured into in and may be found by deducting half breadth from its centre line length at each end. The length of long wall usually decreases from earth work to brick work in super structure while the short wall increases. These lengths are multiplied by breadth and depth to get quantities.

**b) Centre line method:**

This method is suitable for walls of similar cross sections. Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time. When cross walls or partitions or verandah walls join with main all, the centre line length gets reduced by half of breadth for each junction. such junction or joints are studied carefully while calculating total centre line length. The estimates prepared by this method are most accurate and quick.

**c) Partly centre line and partly cross wall method:**

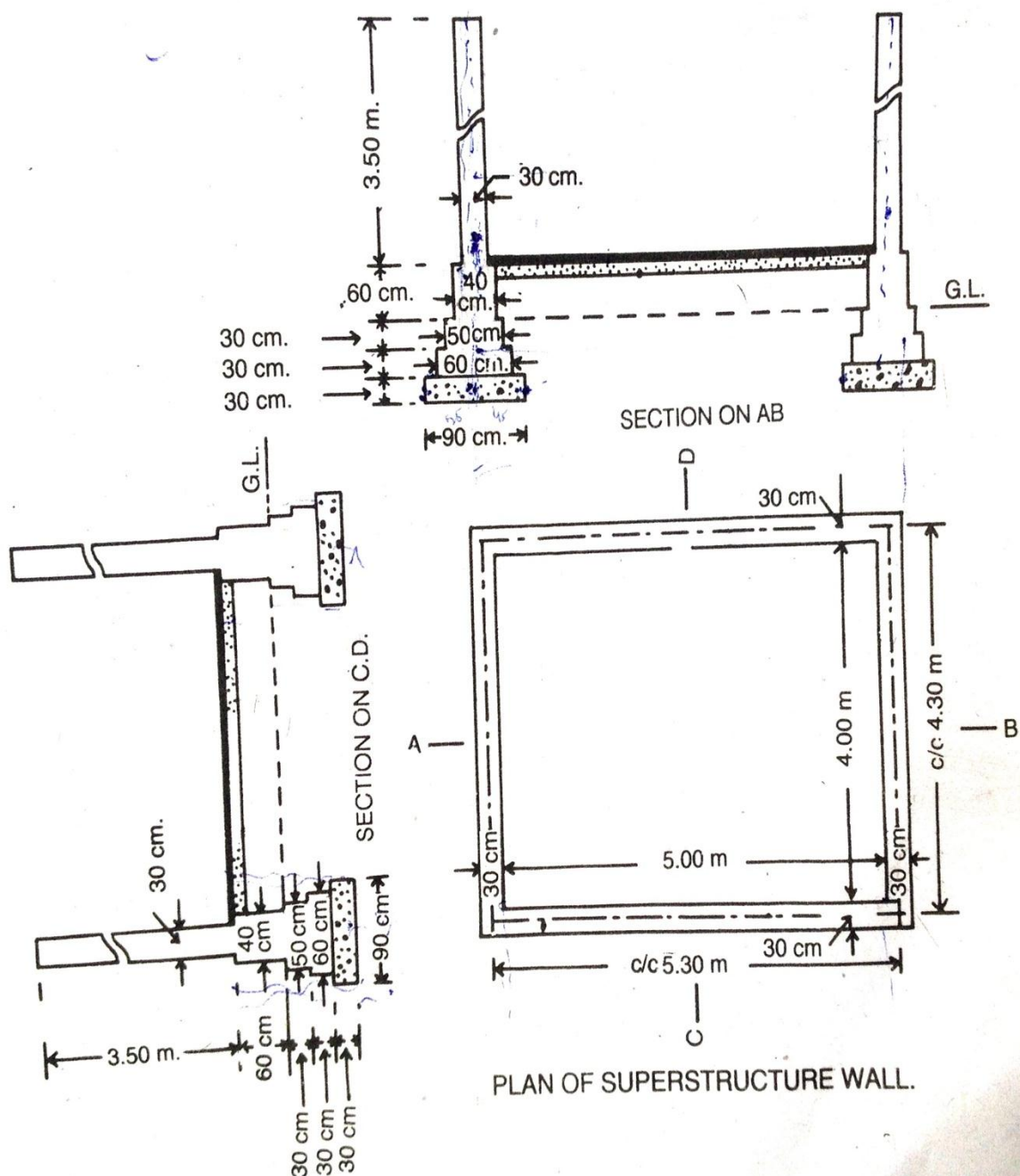
This method is adopted when external (i.e., around the building) wall is of one thickness and the internal walls having different thicknesses. In such cases, centre line method is applied to external walls and long wall-short wall method is used to internal walls. This method suits for different thicknesses wall sand different level of foundations. Because of this reason, all Engineering departments are practicing this method.

**Example 1:** Estimate the quantities of plan of superstructure wall of a single room building of 5 m × 4 m, and sections represent the cross-section of walls with foundation.

1) Earthwork in excavation in foundation , 2) Concrete in foundation, 3) Brick work in foundation , 4) Brick work in superstructure .

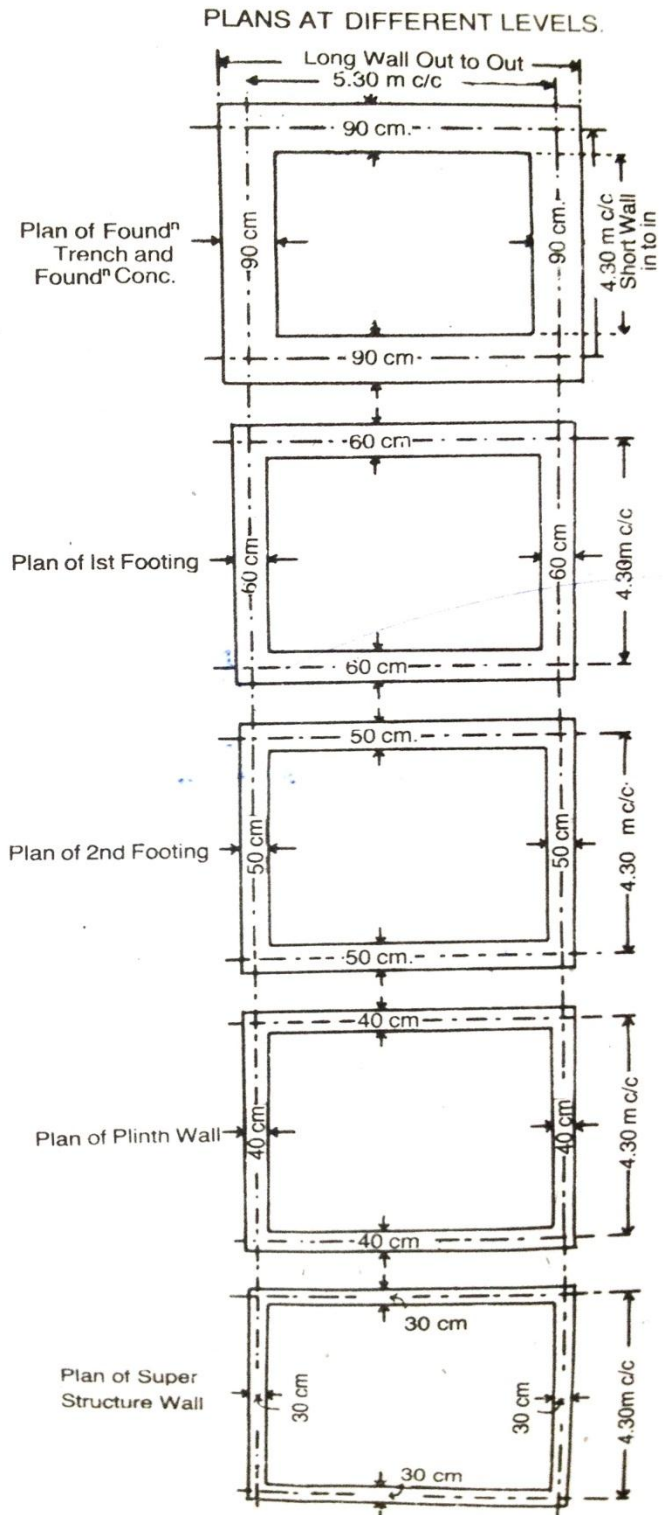
Length of long wall center to center =  $5.00 + \frac{1}{2} \times 0.30 + \frac{1}{2} \times 0.30 = 5.30$  m.

Length of short wall center to center =  $4.00 + \frac{1}{2} \times 0.30 + \frac{1}{2} \times 0.30 = 4.30$  m.



To estimate the quantities, the plan of foundation trench and foundation concrete, the plan of each footings or steps of wall may be imagined as given in Fig. 2-4. Then the long wall in-to-in and the short wall in-to-in of each part may be dealt one by one.

Fig. 2-4



### Details of measurement and calculations of quantities

Item no.	Particulars of items	NO.	Length	Breadth	Height or depth	Quantity	
1	<b>Earthwork in excavation in foundation.</b>						
	Long walls	2	6.20 m	0.90 m	0.90 m	10.04	
	Short walls	2	3.40 m	0.90 m	0.90 m	5.51	
					<b>Total</b>	<b>15.55 cu m</b>	
2	<b>Concrete in foundation</b>						
	Long walls	2	6.20 m	0.90 m	0.30 m	3.35	
	Short walls	2	3.40 m	0.90 m	0.30 m	1.83	
					<b>Total</b>	<b>5.18 cu m</b>	
3	<b>Brickwork in foundation and plinth</b>						
	Long Walls	1 <sup>st</sup> footing	2	5.90 m	0.60 m	0.30 m	2.13
		2 <sup>nd</sup> footing	2	5.80 m	0.50 m	0.30 m	1.74
		Plinth walls	2	5.70 m	0.40 m	0.60 m	2.74
	Short walls	1 <sup>st</sup> footing	2	3.70 m	0.60 m	0.30 m	1.33
		2 <sup>nd</sup> footing	2	3.80 m	0.50 m	0.30 m	1.14
		Plinth walls	2	3.90 m	0.40 m	0.60 m	1.87
					<b>Total</b>	<b>10.96 cu m</b>	
	4	<b>Brickwork in Super Structure</b>					
		Long Walls	2	5.60 m	0.30 m	3.50 m	11.76
Short Walls		2	4.00 m	0.30 m	3.50 m	8.40	
					<b>Total</b>	<b>20.16 cu m</b>	

**Example 2:** Estimate the quantities of the following items of a two roomed building from the given plan and section.

- 1) Earthwork in excavation in foundation
- 2) Lime concrete in foundation
- 3) First class brickwork in cement mortar 1:6 in foundation and plinth
- 4) 2.5 cm c.c. damp course, and
- 5) 1<sup>st</sup> class brickwork in lime mortar in superstructure.

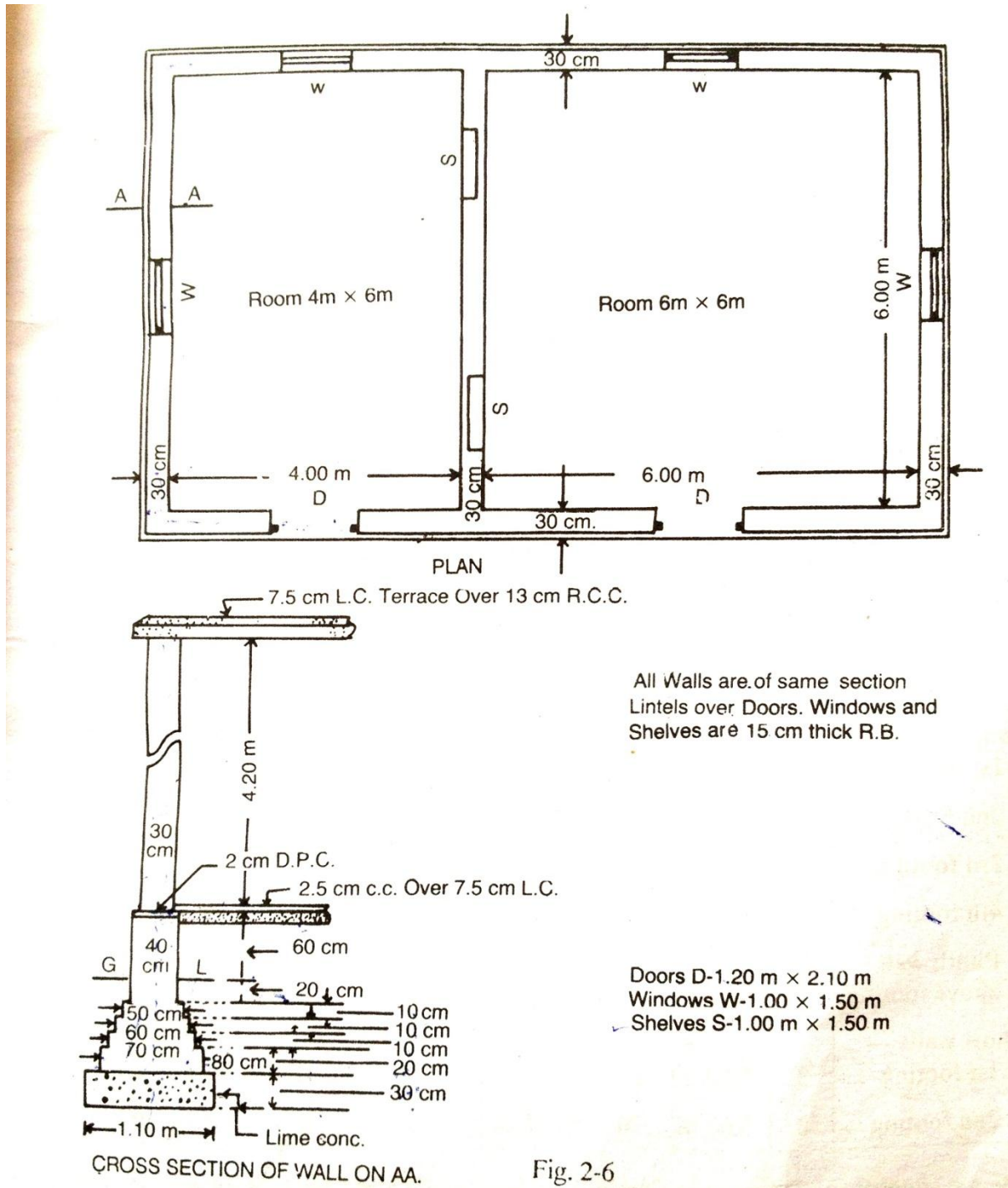


Fig. 2-6

### Details of measurement and calculations of quantities

Item no.	Particulars of items	NO.	Length	Breadth	Height or depth	Quantity	
1	<b>Earthwork in excavation in foundation.</b>						
	Long walls	2	11.7 m	1.10 m	1.00 m	25.74	
	Short walls	2	5.20 m	1.10 m	1.00 m	17.16	
					<b>Total</b>	<b>42.90 cu m</b>	
2	<b>Lime Concrete in foundation</b>						
	Long walls	2	11.7 m	1.10 m	0.30 m	7.72	
	Short walls	3	5.20 m	1.10 m	0.30 m	5.15	
					<b>Total</b>	<b>12.87 cu m</b>	
3	<b>1<sup>st</sup> class Brickwork in 1:6 cement mortar in foundation and plinth</b>						
	Long Walls	1 <sup>st</sup> footing	2	11.40 m	0.80 m	0.20 m	3.65
		2 <sup>nd</sup> footing	2	11.30 m	0.70 m	0.10 m	1.58
		3 <sup>rd</sup> footing	2	11.20 m	0.60 m	0.10 m	1.34
		4 <sup>th</sup> footing	2	11.10 m	0.50 m	0.10 m	1.11
		Plinth walls above footing	2	11.00 m	0.40 m	0.80 m	7.04
	Short walls	1 <sup>st</sup> footing	3	5.50 m	0.80 m	0.20 m	2.64
		2 <sup>nd</sup> footing	3	5.60 m	0.70 m	0.10 m	1.18
		3 <sup>rd</sup> footing	3	5.70 m	0.60 m	0.10 m	1.03
		4 <sup>th</sup> footing	3	5.80 m	0.50 m	0.10 m	1.03
		Plinth walls	3	5.90 m	0.40 m	0.80 m	5.66
					<b>Total</b>	<b>26.10 cu m</b>	
	4	<b>Damp proof course 2.5 cm thick c.c</b>					
		Long Walls	2	11.00 m	0.40 m	-	8.80
Short Walls		2	5.90 m	0.40 m	-	7.08	
					<b>Total</b>	<b>15.88 cu m</b>	
	Deduct door sills	2	1.20 m	0.40 m	-	<b>0.96</b>	



					<b>Net Total</b>	<b>14.92 sq m</b>
5	<b>1<sup>st</sup> class brick work in lime mortar in superstructure</b>					
	Long Walls	2	10.90 m	0.30 m	4.20 m	<b>27.47</b>
	Short Walls	3	6.00 m	0.30 m	4.20 m	<b>22.68</b>
					<b>Total</b>	<b>50.15 cu m</b>
	<b>Deduct</b>					
	Door openings	2	1.20 m	0.30 m	2.10 m	<b>1.51</b>
	Window openings	4	1.00 m	0.30 m	1.50 m	<b>1.80</b>
	Shelves	2	1.00 m	0.20 m	1.50 m	<b>0.60</b>
	Lintels over door	2	1.50 m	0.30 m	0.15 m	<b>0.14</b>
	Lintels over window openings	4	1.30 m	0.30 m	0.15 m	<b>0.23</b>
	Lintels over shelves	2	1.30 m	0.30 m	0.15 m	<b>0.12</b>
				<b>Total of deductions</b>	<b>4.40 cu m</b>	
				<b>Net total</b>	<b>45.75</b>	

**Example 3:** Estimate by central line method the quantities of the following items of a two roomed building fig. of example 2

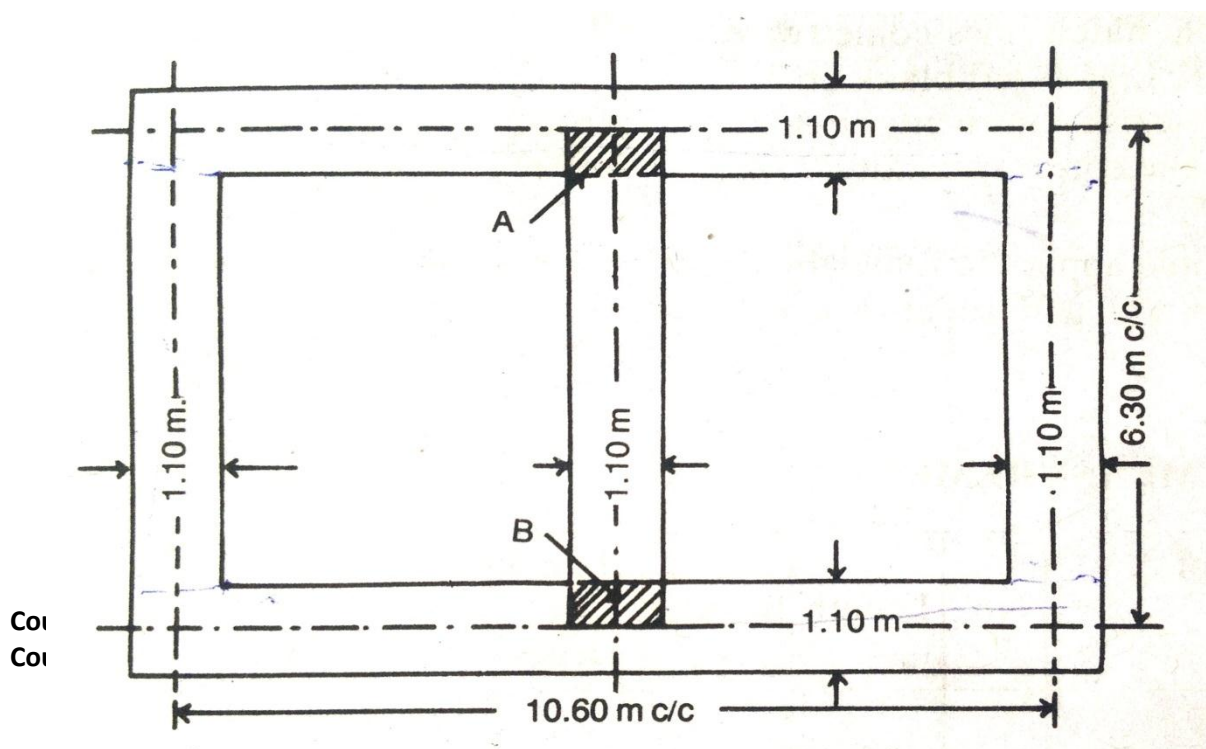
- 1) Earthwork in excavation in foundation
- 2) Lime concrete in foundation,
- 3) First class brickwork in cement mortar 1:6 in foundation and plinth,
- 4) 2.5 cm c.c. damp course, and
- 5) 1<sup>st</sup> class brickwork in lime mortar in superstructure.

**Solution:** In this problem there are two junctions of inner wall with the main wall.

Total centre length of wall =  $2 \times \text{C. to C. of long wall} + 3 \times \text{C. to C. of short wall}$ .

$$= 2 \times 10.63 + 3 \times 6.30 = 40.10 \text{ m}$$

Fig. Represents the foundation trench plan





Thus the quantity of earthwork in excavation

= [Total centre length  $-(2 \times \frac{1}{2} \text{ breadth})$ ]  $\times$  breadth  $\times$  depth.

=  $(40.10 - 2 \times \frac{1}{2} \times 1.10) \times 1.10 \times 1.00 = 42.90 \text{ cu m}$

Item No.	Particulars of items	No.	Length	Breadth	Height of Depth	Quantity
1	<b>Earthwork in excavation in foundation</b>	1	39.00 m	1.10 m	1.00 m	42.90 cu m
2	<b>Lime concrete in foundation</b>	1	39.00 m	1.10 m	0.30 m	12.87 cu m
3	<b>1<sup>st</sup> class brickwork in 1:6 cement mortar in foundation and plinth</b>					
	1 <sup>st</sup> footing	1	39.30 m	0.80 m	0.20 m	6.26
	2 <sup>nd</sup> footing	1	39.40 m	0.70 m	0.10 m	2.76
	3 <sup>rd</sup> footing	1	39.50 m	0.60 m	0.10 m	2.37
	4 <sup>th</sup> footing	1	39.60 m	0.50 m	0.10 m	1.98
	Plinth wall above footing	1	39.70 m	0.40 m	0.80 m	12.70
					<b>Total</b>	<b>26.10 cu m</b>
4	<b>Damp proof course 2.5 cm c.c.</b>	1	39.70 m	0.40 m	-	15.88
	Deduct door sills	2	1.20m	0.40 m	-	0.96
					<b>Total</b>	<b>14.92</b>
5	1 <sup>st</sup> class brickwork in lime mortar in super structure	1	39.80 m	0.30 m	4.20 m	50.15
	<b>Deduct</b>					
	Door openings	2	1.20 m	0.30 m	2.10 m	<b>1.51</b>
	Window openings	4	1.00 m	0.30 m	1.50 m	<b>1.80</b>
	Shelves	2	1.00 m	0.20 m	1.50 m	<b>0.60</b>
	Lintels over door	2	1.50 m	0.30 m	0.15 m	<b>0.14</b>
	Lintels over window openings	4	1.30 m	0.30 m	0.15 m	<b>0.23</b>
	Lintels over shelves	2	1.30 m	0.30 m	0.15 m	<b>0.12</b>
						<b>Total of deductions</b>
					<b>Net Total</b>	<b>45.75 cu m</b>

## **Topic : Specifications of Buildings**

- Describes the nature and class of work, materials to be used in work etc.
- Describe quantity of materials, proportion of mortar, workmanship etc. which are not mentioned in drawings.
- Drawings and Specifications collectively define the full structure.

### **Factors**

The factors on which specifications depend upon are mentioned below :

- Nature of the work
- Strength of materials
- Availability of materials
- Quality of Materials

### **Classification**

Specifications are of two types :

- General or Brief Specification : It is different for different classes of buildings i.e.
  - First Class
  - Second Class
  - Third Class
  - Fourth Class
- Detailed Specifications

### **General Specification (for First Class Buildings)**

- Foundation and Plinth :
- DPC : 1:1.5:3 cement concrete of 1” thickness with standard water proofing material mixed with cement and two coatings of bitumen
- Flooring :

### General Specifications for Foundation and Plinth

1 <sup>st</sup> class Buildings	2 <sup>nd</sup> Class Buildings	3 <sup>rd</sup> Class Buildings	4 <sup>th</sup> class buildings
Ist class brickwork in 1:6 cement mortar over 1:4:8 cement concrete	Ist class brickwork with lime mortar over lime concrete	IInd class brickwork in lime mortar over lime concrete	Sun-dried or kutcha bricks in mud mortar

### General Specifications for Damp Proof Course

1 <sup>st</sup> class Buildings	2 <sup>nd</sup> Class Buildings	3 <sup>rd</sup> Class Buildings	4 <sup>th</sup> class buildings
1:1.5:3 cement concrete of 1" thickness with standard water proofing material mixed with cement and two coatings of bitumen	1:2 cement mortar of 2cm thickness with standard water proofing material	1:2 cement mortar of 2cm thickness with standard water proofing material	....

### General specifications of super structures

1 <sup>st</sup> class Buildings	2 <sup>nd</sup> Class Buildings	3 <sup>rd</sup> Class Buildings	4 <sup>th</sup> class buildings
First class brickwork with 1:6 cement mortar. Lintels over doors and windows shall be of RCC.	Second class brickwork in lime mortar. Lintels over doors and windows shall be of RB.	Second class brickwork in mud mortar. Doors and window openings provided with arches of second class brickwork in lime mortar or wooden planks	Sun-dried or kutcha bricks in mud mortar. Doors and window openings provided with arches of second class brickwork in lime mortar or wooden planks

### General Specifications for Roofing

1 <sup>st</sup> class Buildings	2 <sup>nd</sup> Class Buildings	3 <sup>rd</sup> Class Buildings	4 <sup>th</sup> class buildings
Height of rooms shall not be less than 12'. Over RCC slab insulation layer should be provided	R.B. slab with 7.5cm lime concrete terracing aove (Flat terraced roofs over wooden beams or Jack arched roofs)	Mud over bricks or planks over wooden beams OR G.I. sheet sloping roof	Tile roof over bamboo and wooden supports

### General Specifications of Flooring

1 <sup>st</sup> class Buildings	2 <sup>nd</sup> Class Buildings	3 <sup>rd</sup> Class Buildings	4 <sup>th</sup> class buildings
2.5cm cement concrete over 7.5cm lime concrete	2.5cm cement concrete over 7.5cm lime concrete. Verandah floor shall be of brick tile over lime concrete	Brick on edge floor over well rammed earth	Kutchha floor or earthen floor finished with cow-dung lapping.

### General Specifications of Finishing

1 <sup>st</sup> class Buildings	2 <sup>nd</sup> Class Buildings	3 <sup>rd</sup> Class Buildings	4 <sup>th</sup> class buildings
Inside and outside shall be 12mm cement lime plastered 1:1:6. Inside and outside whitewashed with interior distempered	Inside and outside shall be 12mm cement mortar plastered 1:6. Ceiling shall be cement plastered 1:3. inside and outside whitewashed	Inside and outside shall be plastered with lime mortar and whitewashed	Inside and outside shall be water proof mud plastered

### General Specifications of Roads

- **Subgrade** : Well consolidated and compacted with camber 1 in 60
- **Soiling** : Minimum 1' wider than metaled width of road with –
  - Over burnt bricks filled up with sand and 1" thick earth lightly compacted
  - Stone boulders 6" thick well packed and compacted earth over it

- **Inter Coat and Top Coat** : Stone ballast or over burnt brick ballast of 4.5” and consolidated as well as compacted to 3”
- **Bitumen first coat** : Stone grit of 20mm gauge at 220 kg asphalt or Tar no.3 and 1.35 cum stone grit per 100 sqm.
- **Bitumen second coat** : Stone grit of 12mm gauge at 120 kg asphalt and 0.75 cum stone grit per 100 sqm.
- **Brick Edging** : Over burnt bricks on both sides
- **Misc. :**

For heavy traffic wearing surface may be provided with cement concrete

If subgrade is soft or weak well compacted thick sub base of inferior materials to be used