



# UNIVERSITY OF RUHUNA

## Faculty of Engineering

End-Semester 4 Examination in Engineering: February 2020

**Module Number: CE4301**

**Module Name: Building Planning and Cost Estimating**

**[Three Hours]**

**[Answer all questions]**

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[You may refer to the separately provided City of Colombo Development Plan when answering for Q1 and Q2]

- Q1. Figure Q1 is a plan of a proposed land sub-division prepared for residential purposes. Each lot has an area of more than 10 perch (10 p). You are required to check the given plan and answer the following questions referring to the City of Colombo Development Plan.
- a) Propose suitable minimum road widths for all the roads mentioning the minimum number of lots served by each road. [4.0 Marks]
  - b) Is it required to provide an area for recreational activities? Justify your answer. [2.0 Marks]
  - c) Discuss the requirements related to the frontage and the depth of the lots. [2.0 Marks]
  - b) Other than the plan in Figure Q1, what are the necessary documents to get the approval from the relevant local authority? [2.0 Marks]
- Q2.
- a) Consider following proposed construction activities. For each case, explain whether it is required or not to get the approval from the relevant local authority to commence the construction. Use the City of Colombo Development plan to support your answer.
    - i Construction of a four-story shopping complex.
    - ii Alteration of partition walls, floor finishes and ceiling of an existing office building.
    - iii Construction of 1.5 m high boundary wall adjoining to a B-class road.
    - iv Construction of a single story domestic house with an area of 1750 square feet.
    - v Construction of a two-story domestic house with a gross floor area of 2250 square feet and one wall is on a land boundary. [5.0 Marks]
  - b) If you are assigned as the qualified person for a construction project to prepare plans and to supervise building works, describe how you should coordinate with the relevant local authority. [3.0 Marks]
  - c) What is meant by certificate of conformity for occupation? [2.0 Marks]

Q3.

a) Explain three main purposes of preparing an approximate estimate for a construction project.

[3.0 Marks]

b) What are the necessary information required to prepare a preliminary estimate?

[2.0 Marks]

c) Calculate following requirements based on the information provided in Figures Q3(a) and Q3(b).

- i Calculate centerline dimensions
- ii Take-off quantities of excavation work in foundation
- iii Take-off quantities of plinth plaster
- iv Take-off quantities of the Damp Proof Course (DPC)

[10.0 Marks]

Q4. Assume that you are required to estimate the cost to construct a boundary wall to protect your land. As the first step, you plan to construct only one side of the land without openings. Details of the boundary wall are shown in Figure Q4 (a), Q4 (b) and Q4 (c). For this purpose, carry out the following calculations. Assume that reinforcement requirements have already been calculated as an item. Also excavation does not carry any expenses since it can be done by your own with the support of friends.

a) Calculate the quantities of

- i Rubble work in foundation in  $m^3$
- ii Concrete work in columns and column foundation in  $m^3$
- iii Block work in  $m^2$

[3.0 Marks]

b) Calculate the rates for following activities with the resource requirements given in Data Sheet 1 and cost information available in Table Q4.

- i 1  $m^3$  of rubble work in 1:5 cement sand mortar
- ii 1  $m^3$  of 1:2:4(20) concrete
- iii 10  $m^2$  of block work in 1:8 cement sand mortar.

Note: Use first principles to derive the material requirements.

[10.0 Marks]

c) Calculate the total cost for the boundary wall construction.

[2.0 Marks]

Q5.

a) Discuss the reasons for eliminating following items for price adjustment process for construction projects.

- i Preliminary items
- ii Provisional sum items
- iii Extra works

[3.0 Marks]

b) The data given in the Table Q5(a) includes the General Contract data and the details of interim claims No 1, and 2. Table Q5(b) gives input percentages and price indices of construction inputs. Calculate the price adjustment for claim No. 2.

[7.0 Marks]

## Data Sheet 1

### Random Rubble masonry in cement mortar 1:8 in foundation- Per cube

#### Materials

1.30 cubes rubble  
5.00 cwt cement (50 kg bags)  
0.3 cubes sand  
Water (100 gals)

#### Labour

4 day skilled labours  
6 days U/Sk labours

### Mixing of concrete 1:2:4 (¾ ") -Per cube

#### Materials

18 cwt cement (50 kg bags)  
0.5 cubes sand  
0.88 cubes ¾ metal  
1/3 day hire of mixer  
Water (120 gals)

#### Labour

1-day skilled labour  
6 days U/sk labour

### Reinforced Cement concrete in columns and column foundations-Per 0.45 cubes

#### Materials

0.45 cubes of concrete  
Add 10% for wastage  
1 day hire of vibrator

#### Labour

1 day mason  
1 day carpenter  
1 day U/Sk labourer (Vibrator)  
3 days U/Sk Labourer

<u>Cement</u>	Specific gravity	=3.15
	Bulk density in bag form	=1442 kg/m <sup>3</sup>
	Weight of a bag of cement	=50 kg

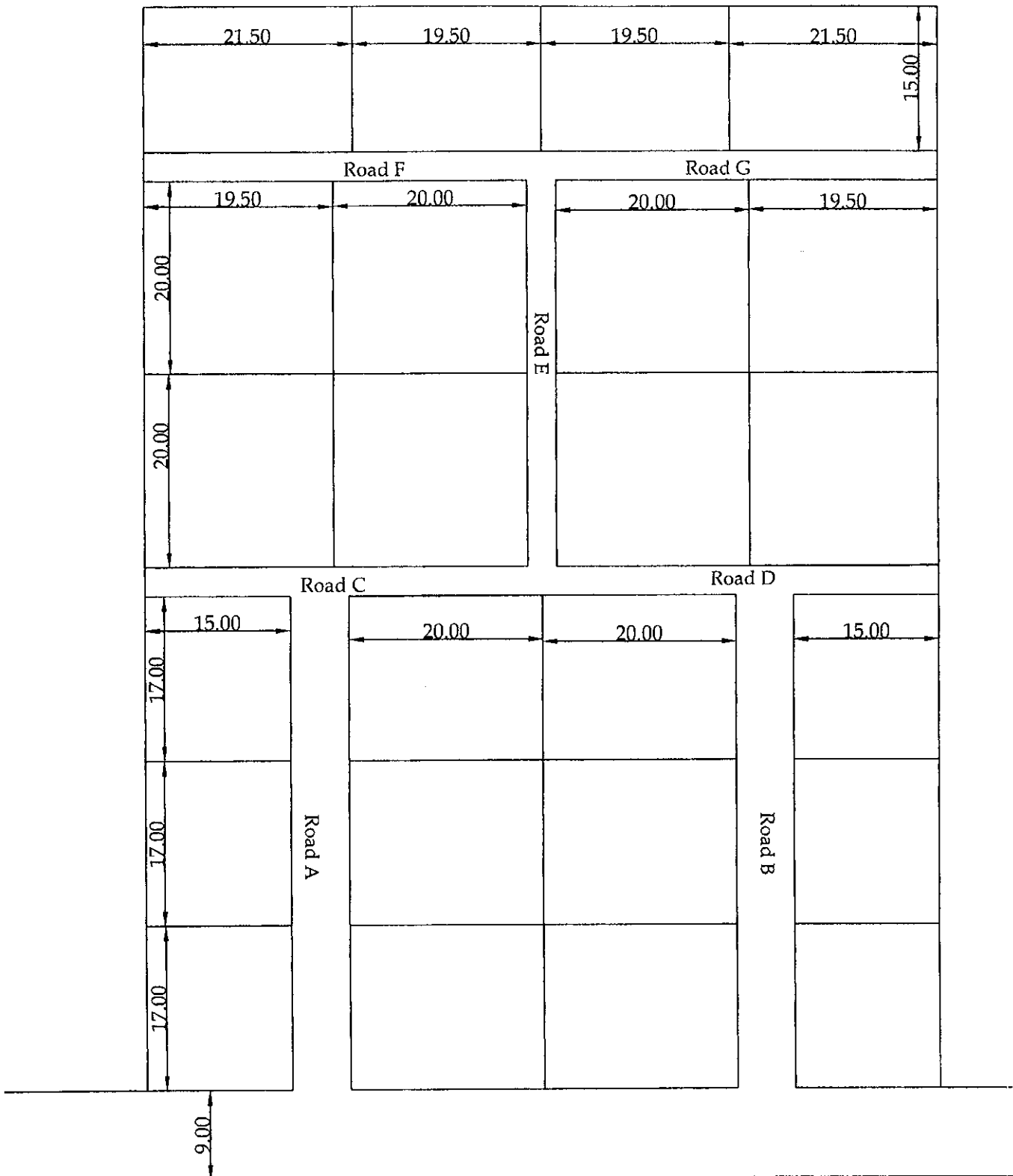
<u>Sand</u>	Specific gravity	=2.66
	Bulk density	=1600 kg/m <sup>3</sup>

<u>Water</u>	Density	=1000 kg/m <sup>3</sup>
	W/C ratio (mortar)	=0.6

<u>Block</u>	390 mm x 150 mm x 165 mm
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### Labour requirement for block work per 1 m<sup>2</sup>

Mason	= 0.5 days
Unskilled labour	=1 day



All Dimensions are in meters  
Not to scale

Figure Q1: Plan of Land Sub-division

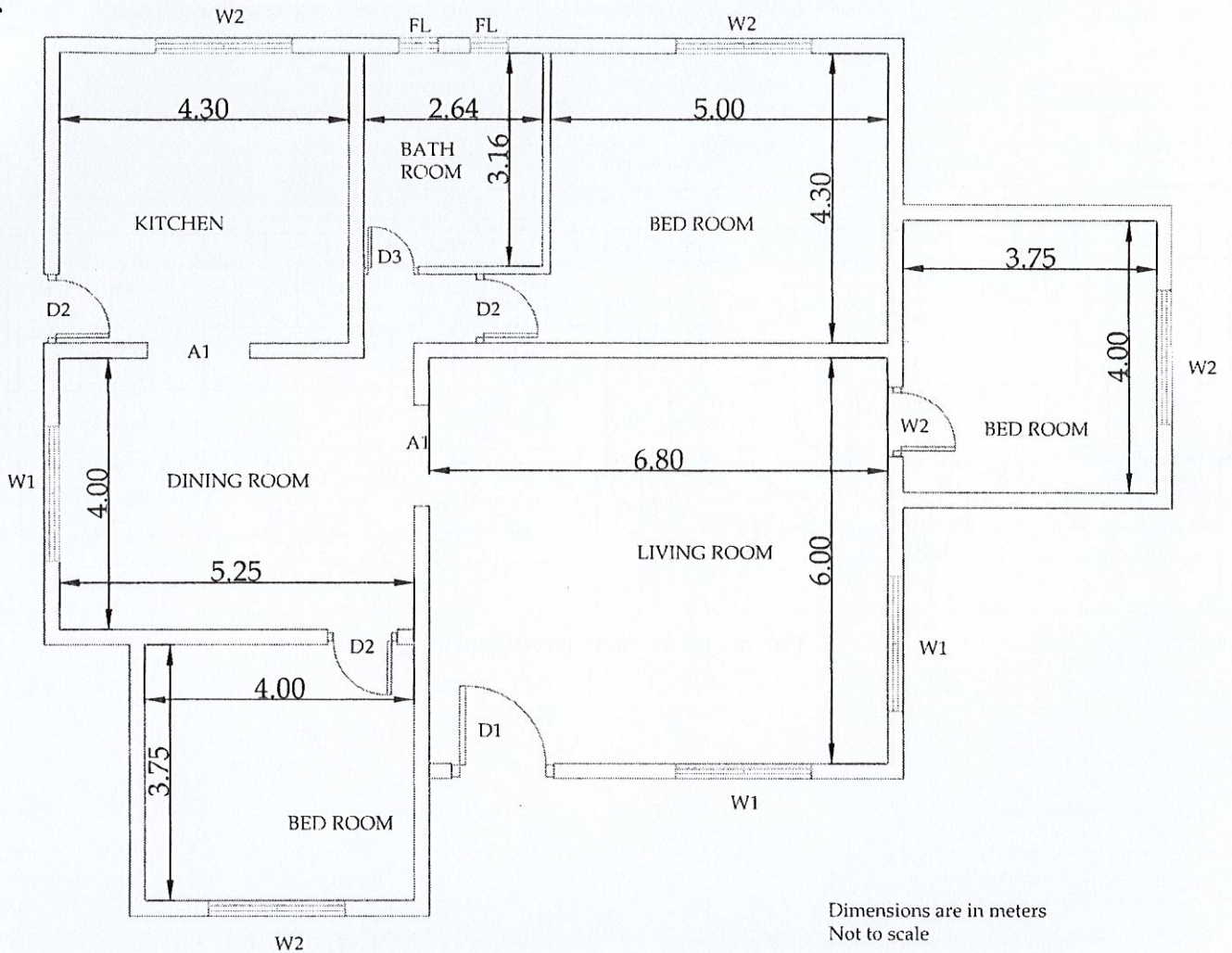


Figure Q3 (a): Ground Floor Plan

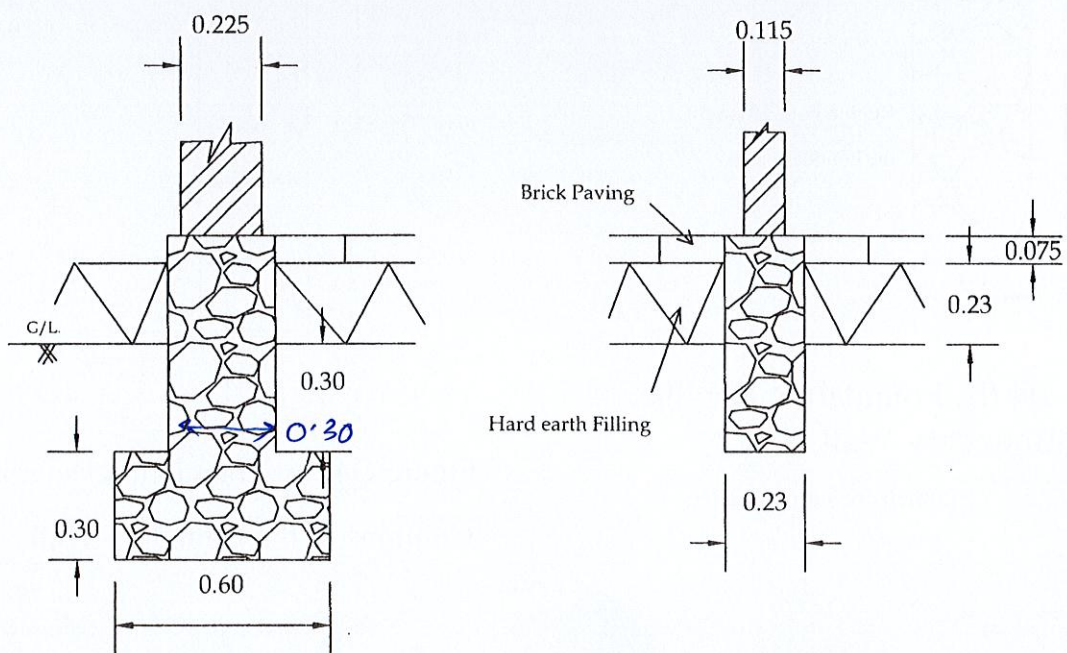


Figure Q3 (b): Foundation Details for House

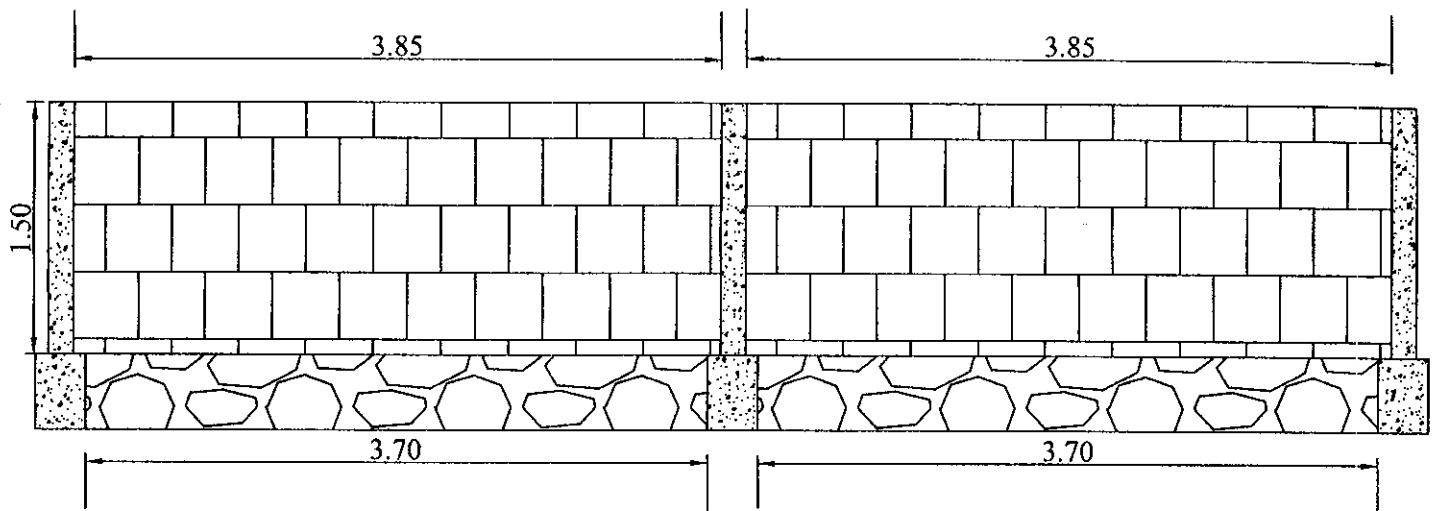


Figure Q4 (a): Boundary Wall Details

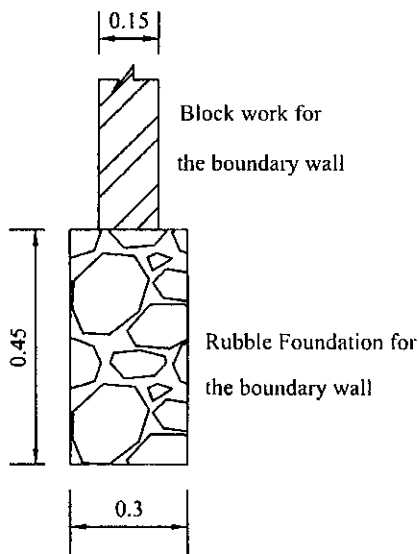


Figure Q4 (b): Foundation Details for Boundary Wall

Dimensions are in meters

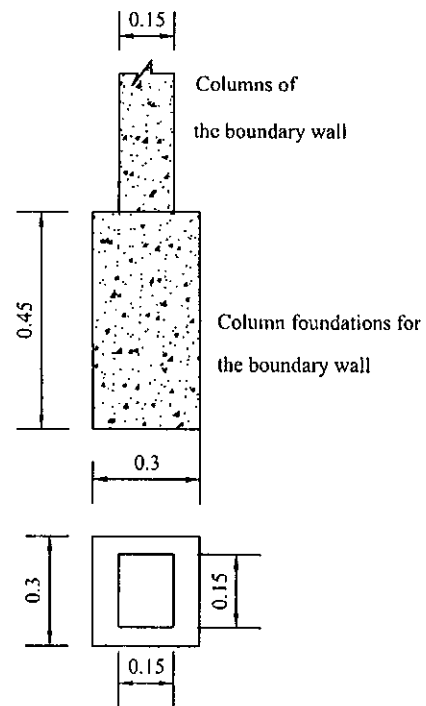


Figure Q4 (c): Foundation Details for Columns of the Boundary Wall

**Table Q4: Cost Data for Unit Rate Analysis (transport included)**

Resource	Price (Rs.)
20mm metal 1 cube	7500.00
Cement bag (50 kg)	1020.00
Sand 1 cube	15000.00
Rubble 1 cube	6000.00
Cement block 1 number	42.00
Water	Free of charge
Mason 8 hour day	2000.00
Unskilled labour 8 hour day	1500.00

Hire of mixer per day 12000.00  
 " " vibrator " " 2000.00  
 compact 2000 per day

**Table Q5 (a): Contract Data**

Contract Data	
Total Contract Sum	Rs. 120,893,650.00
Date of Closing Bids	15- April- 2018
Date of commencement of work	15-June-2018
Claim No. 1	
Date of submission	10-August-2018
Cumulative value of certified work done	Rs.1,070,685.00
Value of Extra work for claim 1	Rs. 75,000.00
Cumulative value of Non-Adjustable work given in BOQ	Rs. 330,000.00
Total Cost of materials at site up to this claim	Rs. 185,000.00
Claim No. 2	
Date of submission	11-Nov-2018
Cumulative value of certified work done	Rs.13,450,600.00
Value of Extra work for claim 2	Rs. 125,000.00
Cumulative value of Non-Adjustable work given in BOQ	Rs. 1,550,000.00
Total Cost of materials at site up to this claim	Rs. 85,000.00

**Table Q5(b): Input Percentages and Price Indices**

Input	Input %	Price indices in 2018								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Cement	13.51	508.0	508.0	508.0	508.0	508.0	508.0	508.0	508.0	521.2
Rubble	2.98	720.8	720.8	733.0	733.0	751.7	751.7	751.7	751.7	751.7
Metal	1.78	394.7	394.7	399.7	399.7	404.0	404.0	404.0	404.0	404.0
Sand	5.9	3516.2	3516.2	3547.6	3552.6	3592.1	3592.1	3592.1	3612.8	3612.8
Brick	8.69	1771.8	1785.0	1785.0	1785.0	1785.0	1785.0	1785.0	1785.0	1785.0
R/f steel	5.26	643.0	643.0	643.0	643.0	643.0	643.0	652.2	710.6	710.6
Asbestos roof	3.77	469.9	469.9	469.9	469.9	469.9	469.9	469.9	482.0	492.6
PVC pipe	2.75	836.8	836.8	859.7	859.7	859.7	859.7	859.7	859.7	859.7
Wall paint	3.35	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3	779.3
Floor tile	2.15	251.1	251.1	255.1	255.1	255.1	255.1	255.1	255.1	255.1
Wall tile	1.35	944.8	944.8	961.4	961.4	961.4	961.4	961.4	961.4	961.4
Electrical fittings	3.8	244.7	244.7	244.7	244.7	244.7	244.7	244.7	244.7	244.7
Skilled Labour	17.98	511.5	511.5	511.5	511.5	511.5	511.5	511.5	511.5	511.5
Unskilled labour	16.73	611.6	611.6	611.6	611.6	611.6	611.6	611.6	611.6	611.6

ICTAD Price Fluctuation Formula

$$F = \frac{0.966(V - V_{na})}{100} * \sum \frac{P_x(I_{xc} - I_{xb})}{I_{xb}} \quad \text{for contracts exceeding Rs. 10 million}$$

All the parameters are with their usual notations.