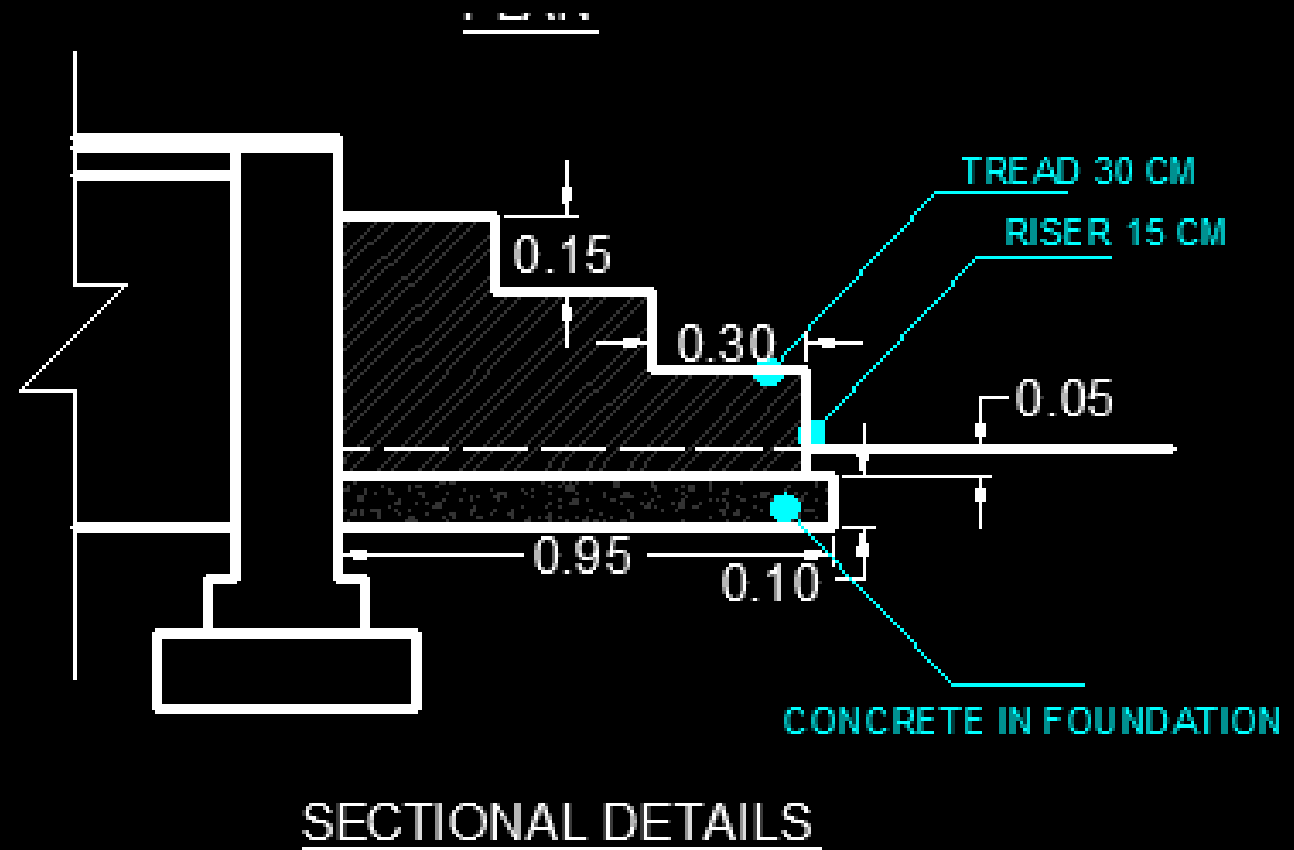
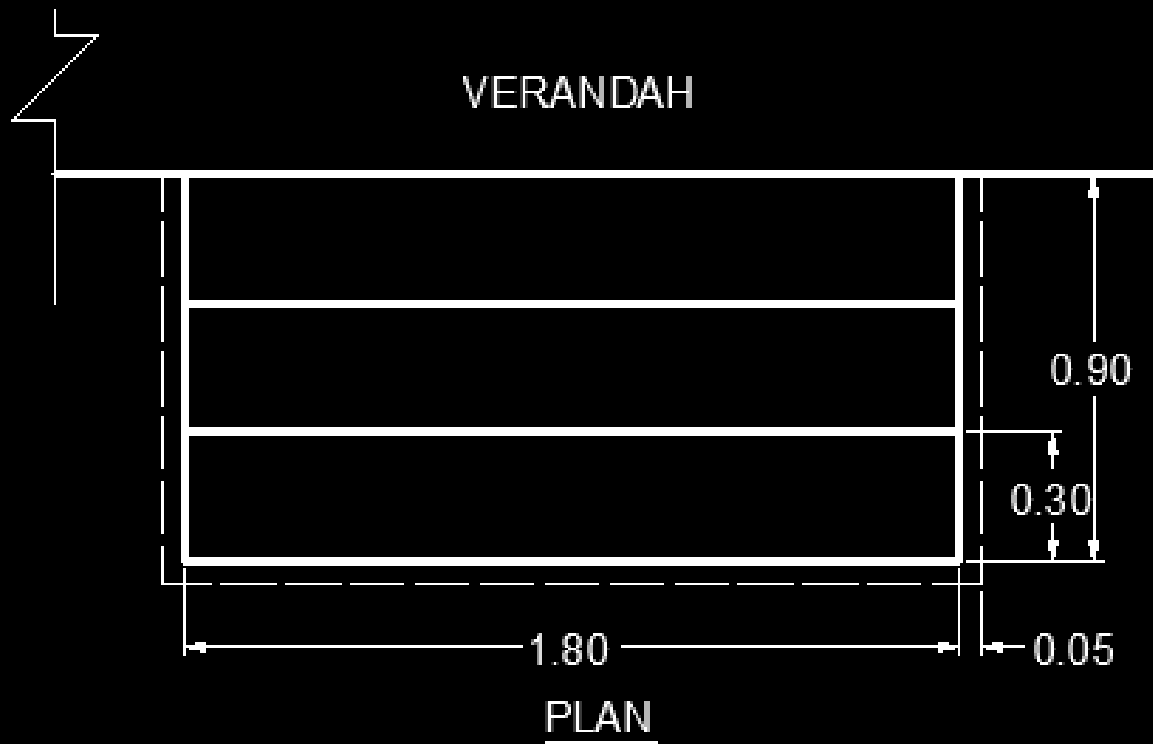


# ESTIMATE OF OTHER CIVIL ENGG. WORKS

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## **BRICK MASONARY – STAIRS**

- Estimate the quantity of Earthwork, Concrete, Brickwork and Finishing work from the given drawings of staircase.



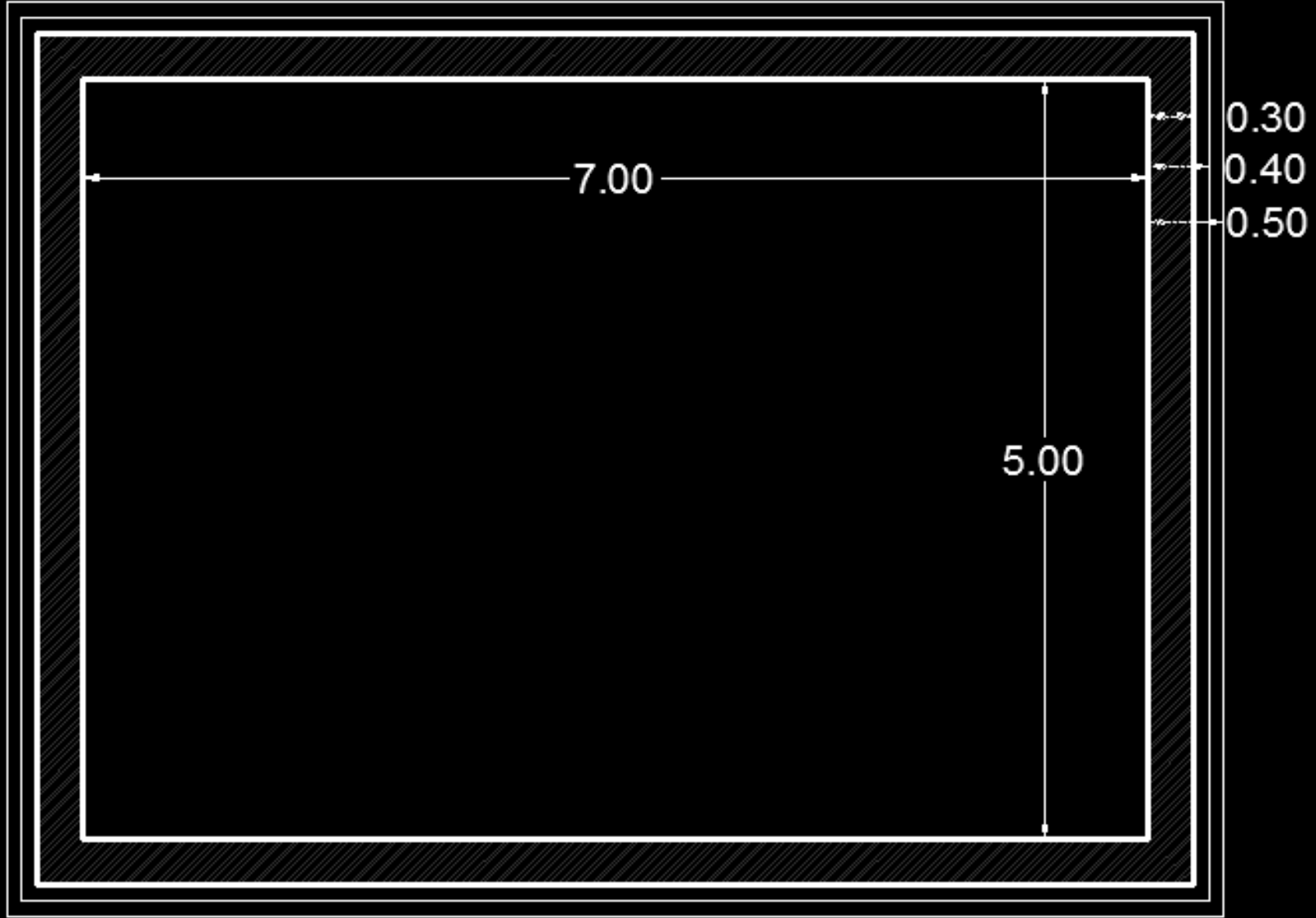
# Detail Estimate

| SR NO | DESCRIPTION OF ITEM     | NOS. | L    | B    | H    | Q     | REMARKS |
|-------|-------------------------|------|------|------|------|-------|---------|
| 1     | Earthwork in excavation | 1    | 1.90 | 0.95 | 0.15 | 0.27  | Cu.mt.  |
| 2     | Concrete in Foundation  | 1    | 1.90 | 0.95 | 0.10 | 0.18  | Cu.mt.  |
| 3     | Brick work              |      |      |      |      |       |         |
|       | 1st Step                | 1    | 1.80 | 0.90 | 0.20 | 0.324 |         |
|       | 2nd Step                | 1    | 1.80 | 0.60 | 0.15 | 0.162 |         |
|       | 3rd Step                | 1    | 1.80 | 0.30 | 0.15 | 0.081 |         |
| 4     | Finishing 20mm Plaster  |      |      |      |      |       |         |
|       | Trades                  | 3    | 1.80 | 0.30 | -    | 1.62  |         |
|       | Risers                  | 4    | 1.80 | -    | 0.15 | 1.08  |         |
|       | Ends                    | 2    | 0.90 | -    | 0.15 | 0.27  |         |
|       |                         | 2    | 0.60 | -    | 0.15 | 0.18  |         |
|       |                         | 2    | 0.30 | -    | 0.15 | 0.09  |         |
|       |                         |      |      |      |      | 3.24  | Sq.mt.  |

# Estimation of Masonry Water tank

- General Specifications: Foundation – Lime concrete – 1<sup>st</sup> class brick work in cement mortar 1:6, Wall finishing – Inside 12mm cement plaster 1:2 with coarse sand, top and outside 12mm cement plaster 1:4 with local sand considering 15cm below ground level. Flooring – 5cm cement concrete 1:1.5:3 over 20cm Lime concrete with neat cement finishing.
  1. Earthwork in excavation – Rs. 350.00 per cu.mt.
  2. Lime concrete in foundation and floor – Rs. 220.00 per cu.mt.
  3. 1<sup>st</sup> class brickwork in 1:6 cement mortar – Rs. 320.00 per cu.mt.
  4. 12mm cement plaster 1:2 with coarse sand – Rs. 8.50 per sq.mt.
  5. 12mm cement plaster 1:4 with local sand – Rs. 8.50 per sq.mt.
  6. 5cm cement concrete 1:1.5:3 – Rs. 55.00 per sq.mt.

**PLAN**

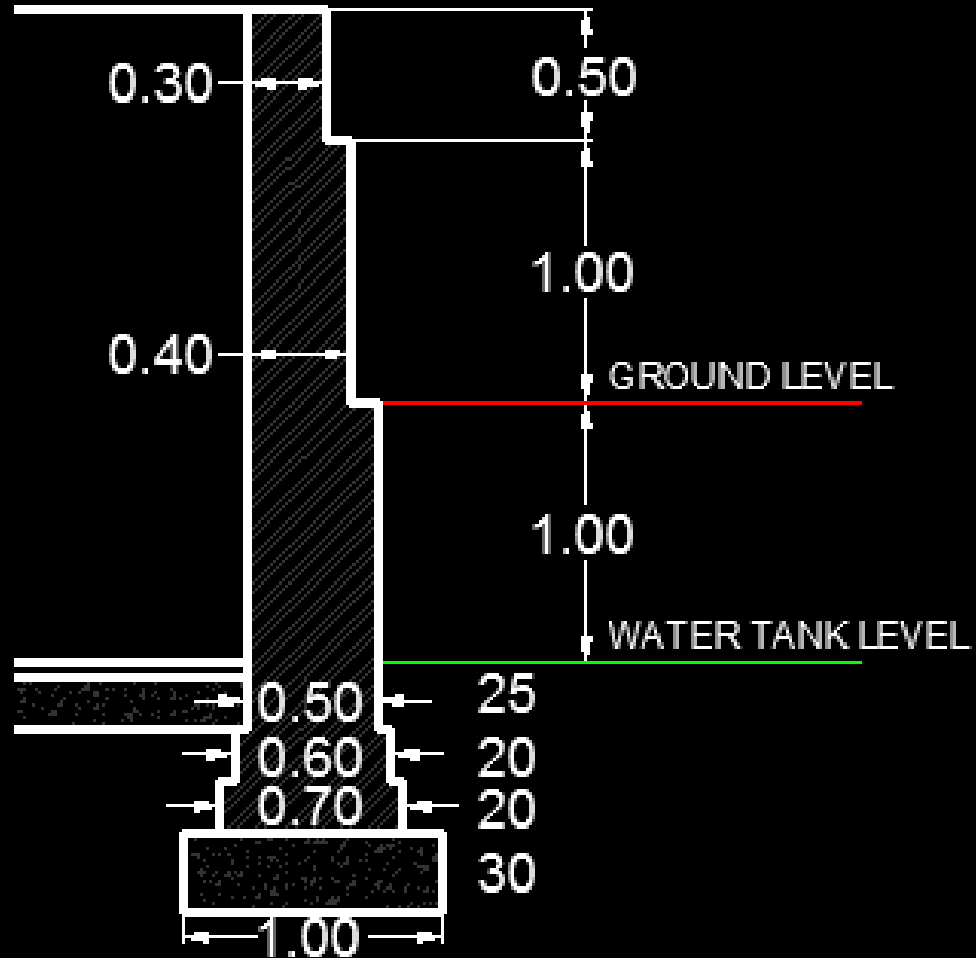


## SECTIONAL ELEVATION



## SECTIONAL DETAILS

## ENLARGED SECTIONAL ELEVATION



### Partition below GL (50cm wall)

Long wall = 7.50 mt, Short wall = 5.50 mt

### Partition above GL (40cm wall)

Long wall = 7.40 mt, Short wall = 5.40 mt

### Partition above GL (30cm wall)

Long wall = 7.30 mt, Short wall = 5.30 mt

# Detail Estimate

| SR NO | DESCRIPTION OF ITEM         | NOS. | L    | B    | H    | Q | REMARKS                      |
|-------|-----------------------------|------|------|------|------|---|------------------------------|
| 1     | Earthwork in excavation     |      |      |      |      |   |                              |
|       | Foundation                  |      |      |      |      |   |                              |
|       | Long wall                   | 2    | 8.50 | 1.00 | 1.95 |   | L = 7.50 + 1.0               |
|       | Short wall                  | 2    | 4.50 | 1.00 | 1.95 |   | L = 5.50 - 1.0               |
|       | Central portion (Inside)    | 1    | 6.50 | 4.50 | 1.25 |   | L = 7.50-1.00, B = 5.50-1.00 |
|       |                             |      |      |      |      |   | Cu.mt.                       |
| 2     | Lime Concrete in Foundation |      |      |      |      |   |                              |
|       | Long wall                   | 2    | 8.50 | 1.00 | 0.30 |   |                              |
|       | Short wall                  | 2    | 4.50 | 1.00 | 0.30 |   |                              |
|       | Central portion (Inside)    | 1    | 7.00 | 5.00 | 0.20 |   |                              |
|       |                             |      |      |      |      |   | Cu.mt.                       |



# Detail Estimate

| SR NO | DESCRIPTION OF ITEM                                 | NOS. | L    | B    | H    | Q | REMARKS           |
|-------|---|------|------|------|------|---|-------------------|
| 3     | 1 <sup>st</sup> class Brick work Below ground level |      |      |      |      |   |                   |
|       | Long wall - 1st footing                             | 2    | 8.20 | 0.70 | 0.20 |   | $L = 7.50 + 0.7$  |
|       | 2nd footing   | 2    | 8.10 | 0.60 | 0.20 |   | $L = 7.50 + 0.6$  |
|       | 50cm wall   | 2    | 8.00 | 0.50 | 1.25 |   | $L = 7.50 + 0.5$  |
|       | Short wall - 1st footing                            | 2    | 4.80 | 0.70 | 0.20 |   | $L = 5.50 - 0.7$  |
|       | 2nd footing   | 2    | 4.90 | 0.60 | 0.20 |   | $L = 5.50 - 0.6$  |
|       | 50cm wall   | 2    | 5.00 | 0.50 | 1.25 |   | $L = 5.50 - 0.5$  |
|       | Above Ground Level                                  |      |      |      |      |   |                   |
|       | 40cm Long wall                                      | 2    | 7.80 | 0.40 | 1.00 |   | $L = 7.40 + 0.40$ |
|       | 40cm Short wall                                     | 2    | 5.00 | 0.40 | 1.00 |   | $L = 5.40 - 0.40$ |
|       | 30cm Long wall                                      | 2    | 7.60 | 0.30 | 0.50 |   | $L = 7.30 + 0.30$ |
|       | 30cm Short wall                                     | 2    | 5.00 | 0.30 | 0.50 |   | $L = 5.30 - 0.30$ |
|       |   |      |      |      |      |   | Cu.mt.            |

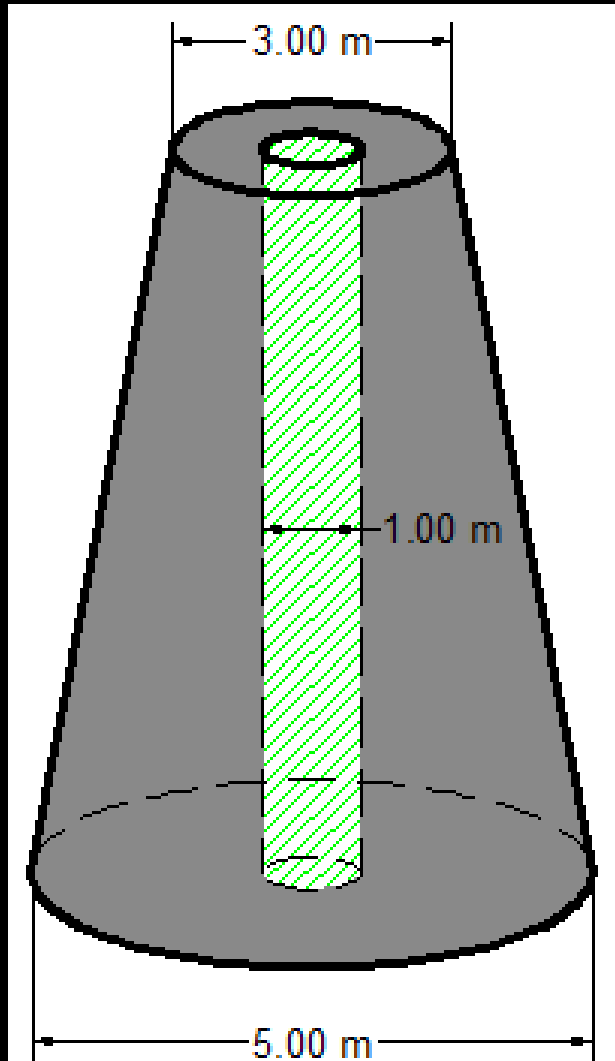
# Detail Estimate

| SR NO | DESCRIPTION OF ITEM            | NOS. | L    | B     | H    | Q | REMARKS  |
|-------|--------------------------------|------|------|-------|------|---|--|
| 4     | 12mm cement plaster 1:2 Inside |      |      |       |      |   |  |
|       | Long walls                     | 2    | 7.00 | -     | 2.50 |   |  |
|       | Short walls                    | 2    | 5.00 | -     | 2.50 |   |  |
|       |                                |      |      | Total |      |   | Sq.mt.   |
| 5     | 12mm plaster outside           |      |      |       |      |   |  |
|       | 40cm Wall - Long walls         | 2    | 7.80 | -     | 1.25 |   | Height including 10cm offset and 15cm below GL |
|       | Short walls                    | 2    | 5.80 | -     | 1.25 |   |  |
|       | 30cm Wall - Long walls         | 2    | 7.60 | -     | 0.60 |   | Height including 10cm offset                   |
|       | Short walls                    | 2    | 5.60 | -     | 0.60 |   |  |
|       | On to of the wall - Long Wall  | 2    | 7.60 | 0.30  | -    |   |  |
|       | Short wall                     | 2    | 5.00 | 0.30  | -    |   |  |
|       |                                |      |      | Total |      |   |  |
| 6     | 5cm Cement Concrete floor      | 1    | 7.00 | 5.00  | -    |   | Sq.mt  |

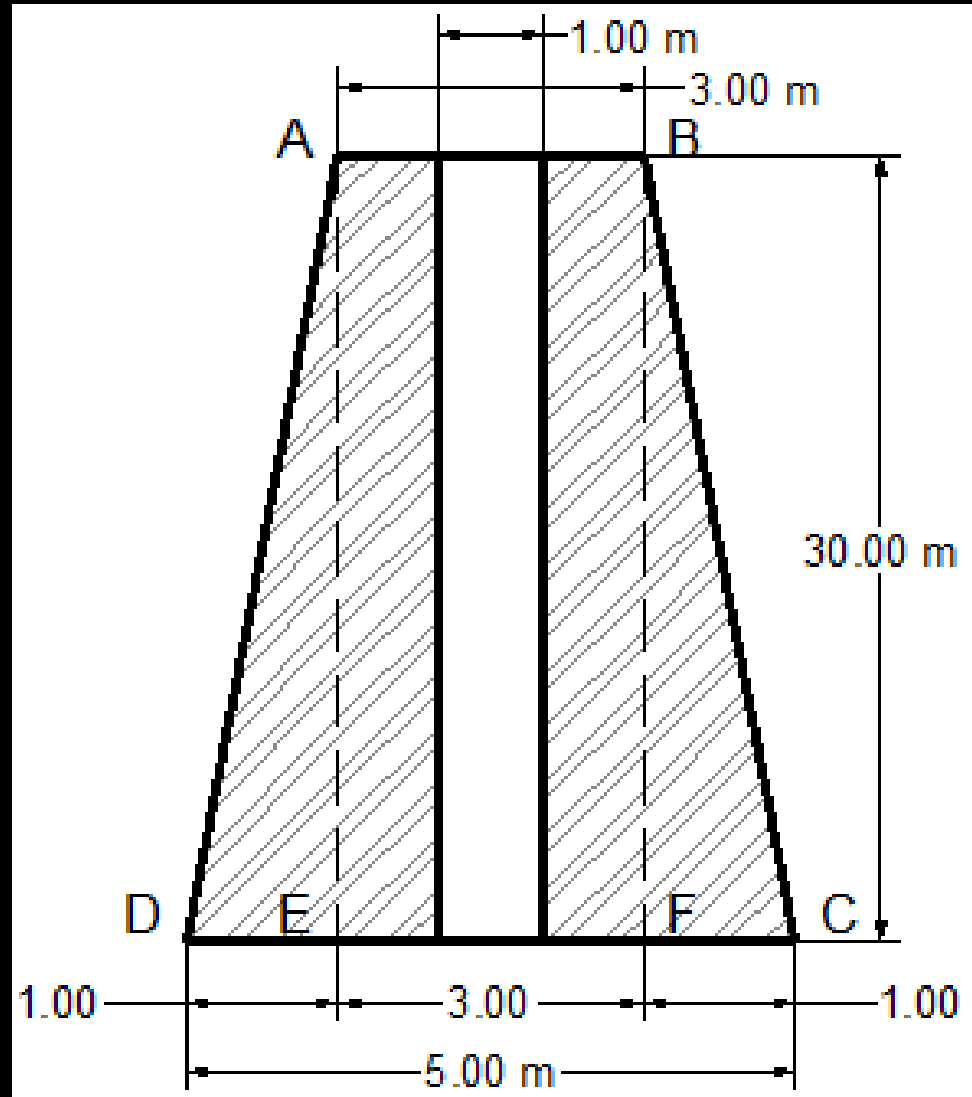
# NUMERICAL 03 – Circular Chimney

- A circular chimney is 30 meters high and has an internal shaft of 1 m diameter throughout its height. The external diameter at the base is 5 m and is uniformly reduced from bottom to the top where the diameter is 3 m. find the quantity of brick masonry, cement pointing on the outer surface and cement plaster on the inner face of shaft.

ISOMETRIC VIEW



SECTIONAL VIEW



# Solution – Volume of Brickwork

By using prismoidal formula,

$$V = h/6 (A_1 + A_2 + 4A)$$

Where h = height

A<sub>1</sub> = Area of one end

A<sub>2</sub> = Area of other end

A = Area in middle section

$$V = \pi h/3 (R^2 + r^2 + Rr)$$

Where h = height

R = Radius at base

r = Radius at the top

Volume = 385 m<sup>3</sup>

**Volume of inner hole**

$$= \pi r^2 h$$

$$= 23.57 \text{ m}^3$$

**Total Quantity of Brickwork**

$$= \underline{385 - 23.57 = 361.43 \text{ m}^3}$$

# Solution – Plastering & Pointing

## Cement pointing on outer surface (Top + Side)

1. Area on top =  $\pi r^2(\text{outer}) - \pi r^2(\text{inner}) = 6.30 \text{ m}^2$

2. Area of curved portion = mean circumference x slant height

Mean(avg.) diameter of chimney = 4m

Mean circumference =  $\pi d = 3.14 \times 4$

Slant Height =  $\sqrt{AE^2 + ED^2} = 30.02 \text{ m}$

Area of curved portion =  $(3.14 \times 4) \times 30.02 = 377.40$

Total area =  $6.30 + 377.40 = 383.70 \text{ m}^2$

# ESTIMATING & COSTING

## ESTIMATION OF RCC ELEMENTS

1

## GENERAL

- RCC work is Generally estimated under two items
  - A concrete work including shuttering and centering (Cu.mt. or Sq.mt.)
  - Binding of steel – Bar Bending Schedule (cwt or Kg)
- As quantity of steel is so small it is not deducted from concrete
- If there is a absence of steel design than following consideration can be made
  - Lintels and Slabs – 0.7% to 1.0%
  - Beams – 1.0% to 2.0%
  - Columns – 1.0% to 5.0%
  - Foundation rafts and footing – 0.5% to 0.8%

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2

# GENERAL

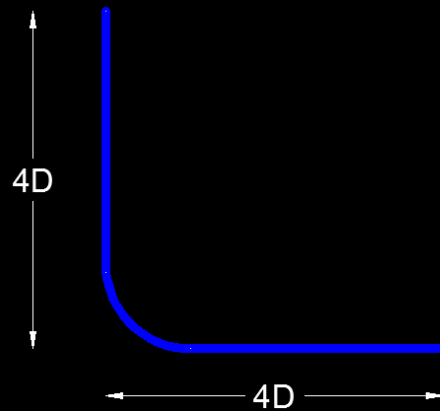
- Side covers for different RCC works
  1. Slab : Side covers 4-5 cm and Top - Bottom covers 1.2 - 2.0 cm
  2. Beams : 2.5 - 5 cm
  3. Column : 2.5 - 5 cm
- Weight of Bar :  $d^2 / 162$

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3

# LENGTH OF HOOKS

90° Bend  
Extra Length of one Bend =  $6D$   
Total length of Bar =  $L + 6D$



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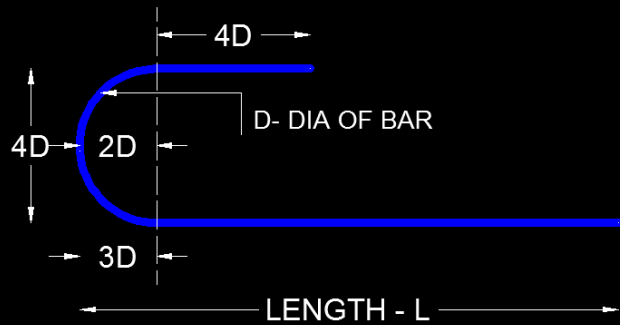


# LENGTH OF HOOKS

180° Bend

Extra Length of one Bend =  $9D$

Total length of Bar =  $L + 9D + 9D = L + 18D$



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# LENGTH OF HOOKS



Overlapping Bars

Extra Length in Tension

=  $40D + 9D + 9D$

=  $58D$  (For Mild steel)

=  $68.5D$  (For Deformed steel)

Overlapping Bars

Extra Length in Compression

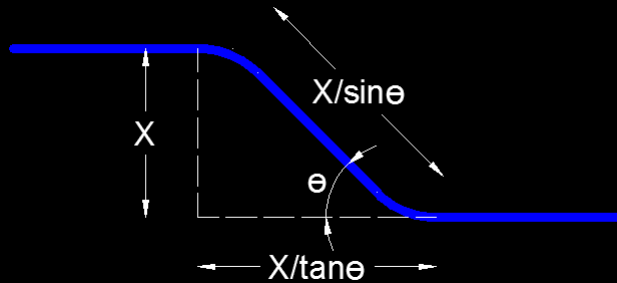
=  $45D + 9D + 9D$

=  $55D$

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## LENGTH OF HOOKS



Bent-up Bar or Cranked Bar  
Extra Length in Tension  
 $= 0.42D$

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## LENGTH OF HOOKS

Lateral ties – Stirrups

$A = X - 2 \text{ covers} - 2 \phi \text{ of bar}$

$B = Y - 2 \text{ covers} - 2 \phi \text{ of bar}$

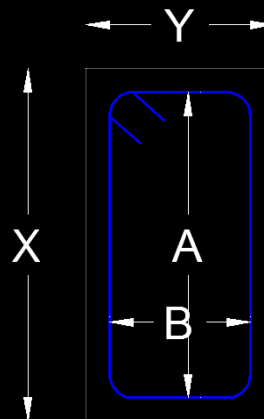
Length of two hooks

$= 2 \times 12D$  or 0.15 m whichever is more

$= 24D$  or 0.15 m whichever is more

Total Length

$2(A + B) + 24D$  or 0.15 m



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## UNIT 02 - BUILDING ESTIMATE

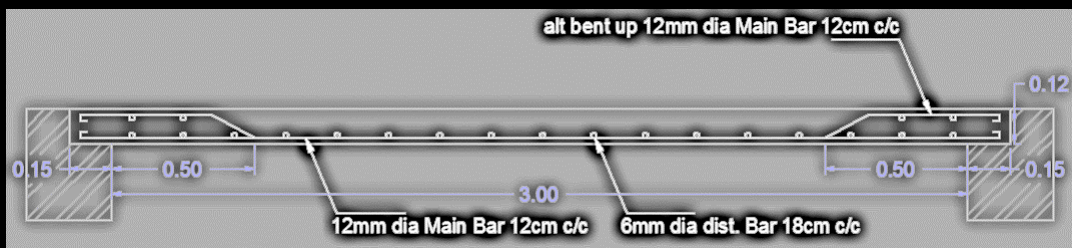
### ESTIMATION OF RCC SLAB & BAR BENDING SCHEDULE

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9

## ESTIMATION AND BBS OF RCC SLAB

- Prepare a detail estimate of RCC roof slab of 3.0mt clear span and 6.0mt long from the given drawing.
- RCC work including centering and shuttering and steel reinforcement in detail shall be taken separately.
- Also prepare a bars bending Schedule.
- Assume side covers as 8cm, also assume one depth addition for length calculations in bent up bars.



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## Detail Estimate

| SR NO | DESCRIPTION OF ITEM   | NOS. | L   | B    | H    | Q     | REMARKS  |
|-------|---|------|---|------|------|-------|--|
| 1     | RCC work 1:2:3 excluding steel and its bending but including centering and shuttering and binding steel | 1    | 6.30  | 3.30 | 0.12 | 2.50  | <b>Cu.mt.</b><br>No deduction for steel bars   |
| 2     | Steel bars including bending (mild steel) in RCC work   |      |   |      |      |       |  |
|       | Main bars 12mm $\emptyset$<br>@ 0.89kg/m - straight bars<br>@ 24cm C/C                                  | 27   | 3.44  |      |      | 92.88 | No. = $((6.30-0.08)/0.24)+1$<br>L = 3.30 - 2xcover + 2 hooks<br>L = 3.30-2 x 0.04 + 18x0.012         |
|       | Bent up bars @ 24cm C/C   | 26   | 3.52  |      |      | 91.52 | No. = $((6.30-0.08)/0.24)$<br>L = 3.30- 2x0.04 + 18x0.012<br><b>+ 0.08 (one depth for two bents)</b> |
|       | <b>TOTAL</b>  |      | <b>184.40 @ 0.89kg/mt</b><br><b>= 184.40 x 0.89 = 164.12 kg</b> |      |      |       | <b>Kg</b>  |

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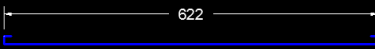

## Detail Estimate

| SR NO | DESCRIPTION OF ITEM  | NOS. | L   | B | H | Q     | REMARKS   |
|-------|--|------|---|---|---|-------|---|
| 3     | Distribution steel 6mm dia<br>@ 0.22 kg/m<br>Bottom bars central portion<br>18cm C/C | 12   | 6.33  |   |   | 75.96 | No. = $(2.00/0.18) + 1$<br>L = 6.30-2x0.04 + 18x0.006 |
|       | Bottom bars two sides  | 6    | 6.33  |   |   | 37.98 | No. = $(0.50/0.18)$                                   |
|       | Top bars two sides   | 6    | 6.33  |   |   | 37.98 |   |
|       | <b>TOTAL</b>   |      | <b>151.92 @ 0.22 kg/mt</b><br><b>= 152.92 x 0.22 = 33.42 kg</b> |   |   |       | <b>Kg</b>   |
|       | <b>Total</b>   |      | <b>164.12 + 33.42 = 197.54 kg</b><br><b>1.975 quintal</b>       |   |   |       |   |

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## BAR BENDING SCHEDULE - SLAB

| DESCRIPTION OF BARS                | SHAPE OF BENDING  | LENGTH (M) | NO | TOTAL LENGTH | WEIGHT |
|------------------------------------|---|------------|----|--------------|--------|
| MAIN STRAIGHT BARS<br>12MM DIA     |  | 3.44       | 27 | 92.88        |        |
| MAIN BENT UP BARS<br>12MM DIA      |  | 3.52       | 26 | 91.52        |        |
|                                    |   |            |    | 184.40       | 164.12 |
| BOTT. DISTRIBUTION<br>BARS 6MM DIA |  | 6.33       | 18 | 113.94       |        |
| TOP DISTRIBUTION BARS<br>6MM DIA   |  | 6.33       | 6  | 37.98        |        |
|                                    |   |            |    | 151.92       | 33.42  |

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## UNIT 02 - BUILDING ESTIMATE

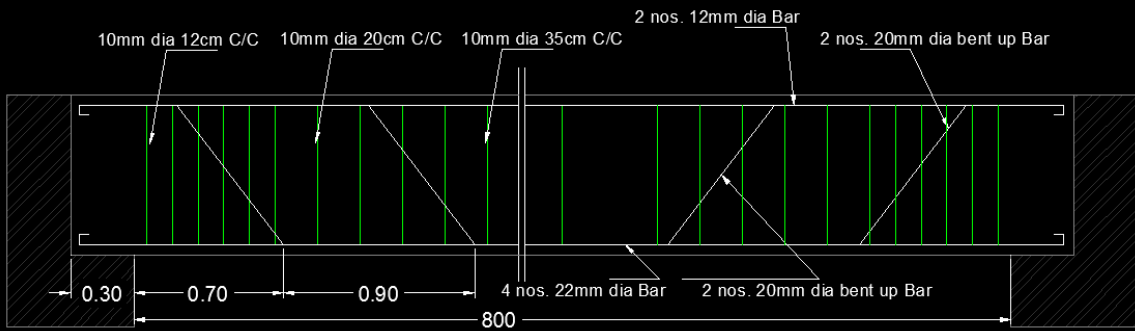
### ESTIMATION OF RCC BEAM & BAR BENDING SCHEDULE

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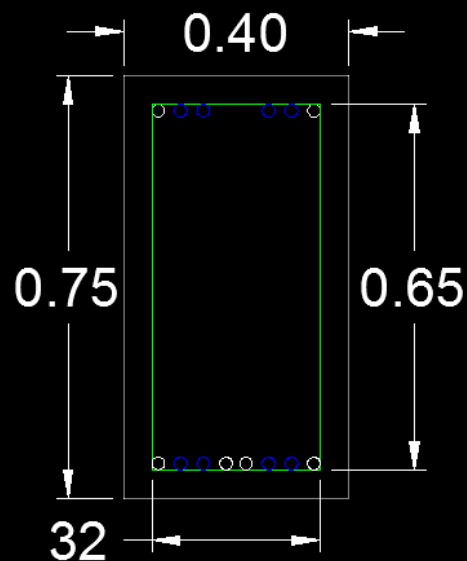
# ESTIMATION AND BBS OF RCC BEAM

- Prepare a detail estimate of RCC beam of 8.0mt clear span and (75 x 40) cm in section from given drawing. RCC work including centering and shuttering and steel reinforcement in detail shall be taken separately, Also prepare a schedule of bars bending.



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## Detail Estimate

| SR NO | DESCRIPTION OF ITEM   | NOS. | L    | B    | H    | Q            | REMARKS   |
|-------|---|------|------|------|------|--------------|---|
| 1     | RCC work 1:2:4 excluding steel and its bending but including centering and shuttering and binding steel | 1    | 8.60 | 0.40 | 0.75 | 2.58         | Cu.mt.<br>No deduction for steel bars   |
| 2     | Steel bars including bending (mild steel) in RCC work   |      |      |      |      |              |   |
|       | Main bars 22mm $\emptyset$<br>@2.98kg/m-straight bars   | 4    | 8.92 |      |      | 106.33<br>Kg | L = 8.60 - 2xcover + 2hooks<br>L = 8.60 - 2x0.04 + 18x0.022                                 |
|       | 20mm $\emptyset$ bent up bars<br>@2.47kg/m  | 4    | 9.44 |      |      | 93.66<br>Kg  | L = 8.60 - 2xcover + 2hooks +<br>2x0.30 (i.e. 0.45 x 0.65)<br>L = 8.60-2x0.04+18x0.020+0.68 |
|       | 12mm $\emptyset$ top bars<br>@0.89kg/m  | 2    | 8.74 |      |      | 15.56<br>kg  | L = 8.60 - 2xcover + 2hooks<br>L = 8.60 - 2x0.04 + 18x0.012                                 |

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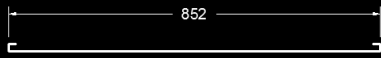



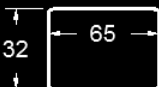
## Detail Estimate

| SR NO | DESCRIPTION OF ITEM   | NOS.  | L    | B | H | Q     | REMARKS   |                     |
|-------|---|---|------|---|---|-------|---|---------------------|
| 2     | Stirrups  |   |      |   |   |       |   |                     |
|       | Stirrups 10mm $\emptyset$<br>@ 0.62kg/m at end 12cmC/C<br>For 70cm length | 7x2   | 2.12 |   |   | 29.68 | L = (0.65x2 + 0.32x2) +<br>(24x0.010) or <b>0.15cm</b><br>Which ever is more<br>No = (0.70/0.12) + 1 = 6.83 |                     |
|       | Stirrups 10mm $\emptyset$<br>@ 0.62kg/m at end 20cmC/C<br>For 90cm length | 5x2   | 2.12 |   |   | 21.20 | No = 0.90/0.20 = 4.5  |                     |
|       |   | <b>50.88 @ 0.62kg/m = 50.88 x 0.62 = 31.55 kg</b> |      |   |   |       |   |                     |
|       | Stirrups 6mm $\emptyset$ @ 0.22kg/m<br>in central portion 35cm C/C        | 14  | 2.12 |   |   | 29.68 | No = 4.8/0.35 = 14.85   |                     |
|       |   | <b>29.68 @ 0.22kg/m = 29.26x0.22 = 6.53 kg</b>    |      |   |   |       |   |                     |
|       |   | <b>Total steel = 253.63 kg</b>                    |      |   |   |       |   | <b>2.54 Quintal</b> |

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## BAR BENDING SCHEDULE - BEAM

| DESCRIPTION OF BARS            | SHAPE OF BENDING  | LENGTH (M) | NO | TOTAL LENGTH | WEIGHT |
|--------------------------------|---|------------|----|--------------|--------|
| MAIN STRAIGHT BARS<br>22MM DIA |  | 8.92       | 4  | 35.68        | 106.33 |
| MAIN BENT UP BARS<br>20MM DIA  |  | 9.48       | 2  | 18.96        | 46.83  |
| MAIN BENT UP BARS<br>20MM DIA  |  | 9.48       | 2  | 18.96        | 46.83  |
| TOP STRAIGHT BARS<br>20MM DIA  |  | 8.74       | 2  | 17.48        | 15.56  |
| STIRRUPS 10MM DIA              |  | 2.09       | 24 | 50.16        | 31.10  |
| STIRRUPS 10MM DIA              |   | 2.09       | 14 | 29.26        | 18.14  |

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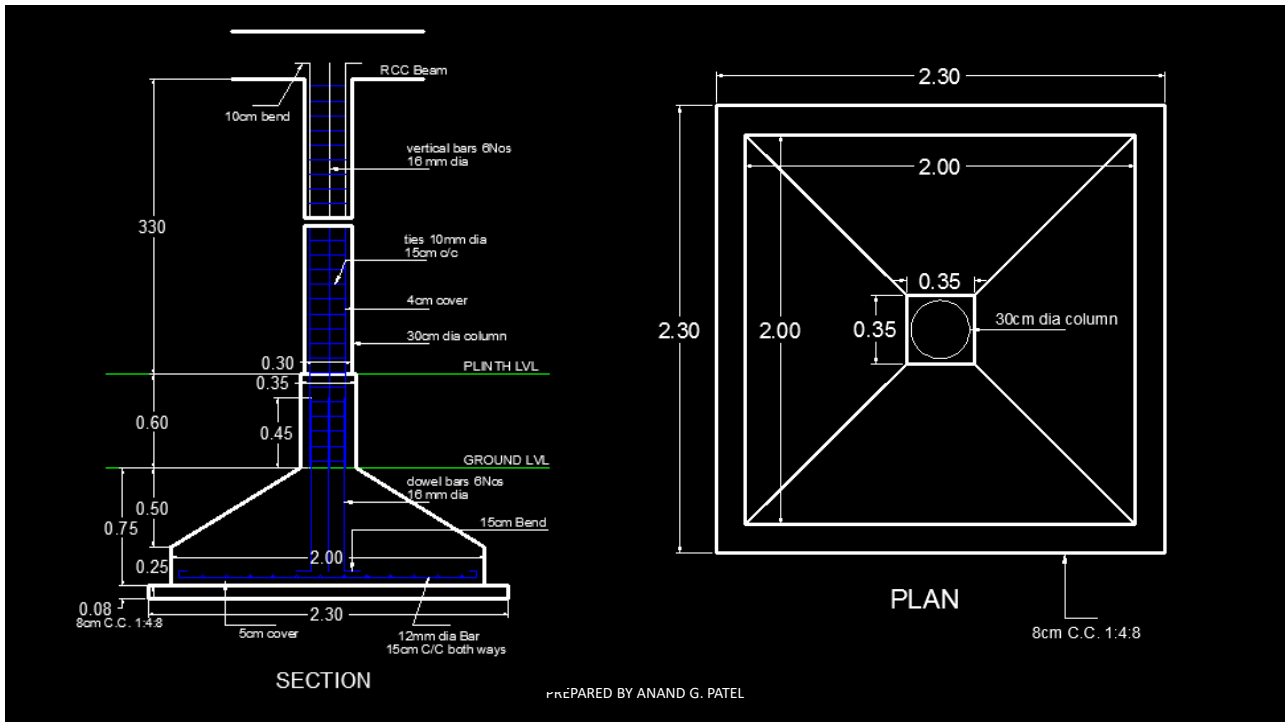
## UNIT 02 - BUILDING ESTIMATE

### ESTIMATION OF RCC COLUMN WITH SLOPPED FOOTING & BAR BENDING SCHEDULE

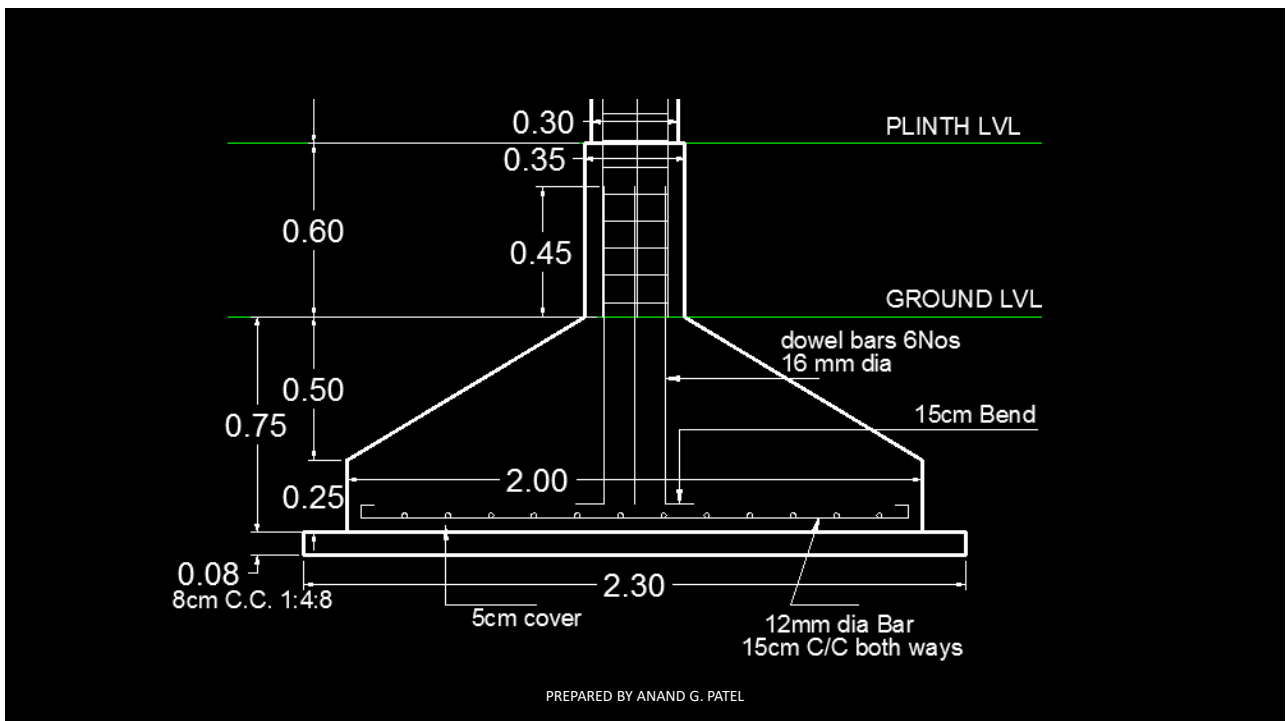
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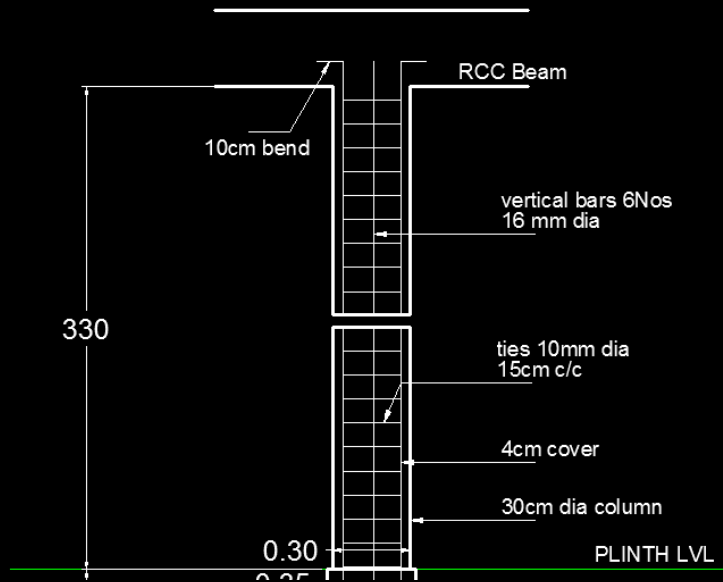




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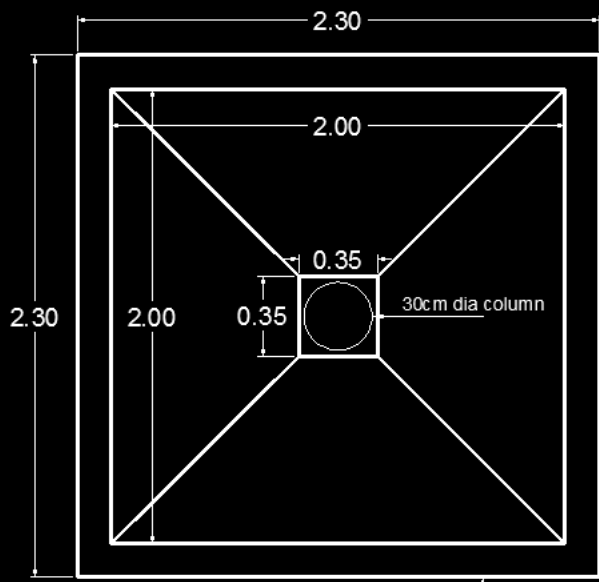


22



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PLAN

8cm C.C. 1:4:8

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## Detail Estimate

| SR NO | DESCRIPTION OF ITEM  | NOS. | L    | B    | H            | Q            | REMARKS       |
|-------|--|------|------|------|--------------|--------------|---------------|
| 1     | Earthwork in excavation in Foundation  | 1    | 2.30 | 2.30 | 0.83         | 4.40         | <b>Cu.mt.</b> |
| 2     | Cement Concrete 1:4:8 in base  | 1    | 2.30 | 2.30 | 0.08         | 0.42         | <b>Cu.mt.</b> |
| 3     | RCC work in footing 1:2:4 excluding steel and its bending but including centering and shuttering and binding steel |      |      |      |              | 1.804        | <b>Cu.mt.</b> |
| 4     | RCC Work in Column   |      |      |      |              |              |               |
|       | Above GL up to Plinth  | 1    | 0.35 | 0.35 | 0.60         | 0.074        | <b>Cu.mt.</b> |
|       | Above Plinth level circular portion, $\pi \times r^2 \times 3.30$  |      |      |      |              | 0.233        |               |
|       |  |      |      |      | <b>Total</b> | <b>0.307</b> | <b>Cu.mt.</b> |

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## Detail Estimate

| SR NO | DESCRIPTION OF ITEM                                     | NOS. | L    | B | H            | Q                | REMARKS   |
|-------|---|------|------|---|--------------|------------------|---|
| 5     | Steel bars including bending                            |      |      |   |              |                  |   |
|       | 12mm $\emptyset$ bars @0.89kg/m- in base footing        | 2x14 | 1.93 |   |              | 48.10 kg         | No.= $(2 - 0.08) / 0.15 + 1$<br>L= $2 - 0.08 - (18 \times 0.012)$   |
|       | 16mm $\emptyset$ dowels @1.58kg/m-vertical bars         | 6    | 1.30 |   |              | 12.33 kg         | L= $0.45 + 0.75 - 0.05 + 0.15$  |
|       | 16mm $\emptyset$ bars @1.58kg/m-vertical bars in column | 6    | 4.00 |   |              | 37.92 kg         | L= $3.30 + 0.60 + 0.10$   |
|       | 10mm $\emptyset$ bars @0.62kg/m in lateral ties         | 27   | 0.93 |   |              | 15.57 kg         | No.= $(3.90 / 0.15) + 1 = 27$<br>L= $2\pi \times r + \text{hooks}$<br>$(2 \times 3.14 \times 0.11) + (24 \times 0.010 \text{ or } 0.15) = 0.70$ |
|       |   |      |      |   | <b>Total</b> | <b>109.78 kg</b> |   |

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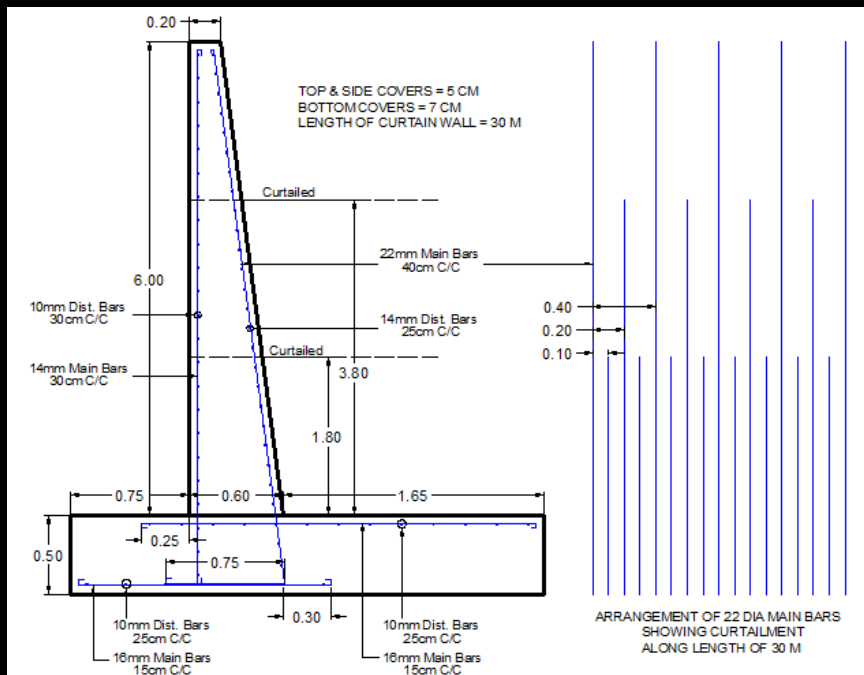
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# UNIT 02

## ESTIMATION OF RCC RETAINING WALL

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## Detail Estimate

| SR NO | DESCRIPTION OF ITEM   | NOS. | L    | B   | H    | Q          | REMARKS  |
|-------|---|------|------|-----|------|------------|--|
| 1     | RCC work 1:2:4 excluding steel and its bending but including centering and shuttering and binding steel | 1    | 30.0 | 3.0 | 0.50 | 45.0       | Cu.mt.<br>No deduction for steel bars  |
|       |   | 1    | 30.0 | 0.4 | 6.0  | 72.0       | $B = (0.6+0.2)/2$  |
|       |   |      |      |     |      | 117.0      | Cu.mt.   |
| 2     | Steel bars including bending (mild steel) in RCC work - STEM  |      |      |     |      |            |  |
|       | R.S. Main bars 22mm $\emptyset$ @2.98kg/m – 40cm C/C  | 76   | 7.53 |     |      | 1705.40 Kg | Nos. = $30 - (2 \times 0.05) / 0.40 + 1$<br>L = $6.5 + 0.75 - 0.05 - 0.07 + (18 \times 0.022)$ |
|       | R.S. Main bars 22mm $\emptyset$ @2.98kg/m – 40cm C/C  | 75   | 5.33 |     |      | 1191.25 Kg | Nos. = $(30 - (2 \times 0.05)) - (2 \times 0.20) / 0.40 + 1$<br>L = $7.53 - 2.20$              |

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## Detail Estimate

| SR NO | DESCRIPTION OF ITEM                                   | NOS. | L     | B | H | Q          | REMARKS   |
|-------|---|------|-------|---|---|------------|---|
| 2     | Cont...   |      |       |   |   |            |   |
|       | R.S. Main bars 22mm $\emptyset$ @2.98kg/m – 20cm C/C  | 150  | 3.33  |   |   | 1488.51 Kg | Nos. = $(30 - (2 \times 0.05)) - (2 \times 0.10) / 0.20 + 1$<br>L = $7.53 - 4.20$   |
|       | R.S. Dist. bars 14mm $\emptyset$ @1.21kg/m – 25cm C/C | 27   | 31.78 |   |   | 1038.25 Kg | Nos. = $6.5 - 0.05 - 0.07 / 0.25 + 1$<br>L = $30 - 0.10 + (2 \times 40 \times 0.014) + (6 \times 9 \times 0.014)$<br>Assuming two Overlap Lengths |
|       | L.S. Main bars 14mm $\emptyset$ @1.21kg/m – 30cm C/C  | 101  | 6.63  |   |   | 810.25 Kg  | Nos. = $30 - 0.10 / 0.30 + 1$<br>L = $6.5 - 0.05 - 0.07 + (2 \times 9 \times 0.014)$  |
|       | L.S. Dist. bars 10mm $\emptyset$ @0.62kg/m – 30cm C/C | 23   | 31.24 |   |   | 445.48 Kg  | Nos. = $6.5 - 0.05 - 0.07 / 0.30 + 1$<br>L = $30 - 0.10 + (2 \times 40 \times 0.010) + (6 \times 9 \times 0.010)$<br>Assuming two Overlap Lengths |

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## Detail Estimate

| SR NO | DESCRIPTION OF ITEM   | NOS. | L     | B | H | Q          | REMARKS   |
|-------|---|------|-------|---|---|------------|---|
| 3     | Steel bars including bending (mild steel) in RCC work – BASE SLAB |      |       |   |   |            |   |
|       | TOE – Main bars 16mm $\phi$ @1.58kg/m – 15cm C/C                  | 200  | 1.89  |   |   | 597.24 Kg  | Nos. = $30 - 0.10/0.15 + 1$<br>L = $0.75 + 0.60 + 0.30 - 0.05 + (18 \times 0.016)$  |
|       | HEEL – Main bars 16mm $\phi$ @1.58kg/m – 10cm C/C                 | 300  | 2.74  |   |   | 1298.76 Kg | Nos. = $30 - 0.10/0.10 + 1$<br>L = $1.65 + 0.60 + 0.25 - 0.05 + (18 \times 0.016)$  |
|       | TOE - Main bars 10mm $\phi$ @0.62kg/m – 25cm C/C                  | 7    | 31.24 |   |   | 135.60 Kg  | Nos. = $(0.75 + 0.60 + 0.30 - 0.05)/0.25 + 1$<br>L = $30 - 0.10 + (2 \times 40 \times 0.010) + (6 \times 9 \times 0.010)$<br>Assuming two Overlap Lengths |
|       | HEEL - Dist. bars 10mm $\phi$ @0.62kg/m – 20cm C/C                | 13   | 31.24 |   |   | 251.80 Kg  | Nos. = $1.65 + 0.65 + 0.25 - 0.05/0.20 + 1$<br>L = AS ABOVE   |

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# ESTIMATING AND COSTING

TYPES OF ESTIMATE, SANCTIONS AND PROJECT

1

## TYPES OF ESTIMATES

### **Preliminary /Approximate /Abstract Estimate**

- Preliminary studies of various aspects, to decide financial position and policies for administrative sanctions.
- Mostly revenue generated projects
- Working-out Cost to benefit ratio
- Prepared through practical knowledge from similar projects
- It includes estimate of important items of work (such as roads, lands, water supply, electrification etc.)
- 5% to 10% contingency is added.

2

## PRELIMINARY /APPROXIMATE /ABSTRACT ESTIMATE

### Various methods for different structures

#### 1. Buildings

- Schools/Hostels : Per Students
- Schools : Per class
- Hospitals : Per bed
- Cinema : Per seat

$$\begin{aligned}
 &\text{Approximate cost of hospital} \\
 &= \text{Numbers of beds} \times \text{Per bed cost} \\
 &= 100 \times 5000 \\
 &= 5,00,000 \text{ Rs}
 \end{aligned}$$

3

## PRELIMINARY /APPROXIMATE /ABSTRACT ESTIMATE

### Various methods for different structures

2. **Roads and Highways** – Per kilometer of length basis depending on nature of road construction and material used
3. **Irrigation channel** – Per kilometer of length depending on capacity of channel
  - Approximate cost of 10km long irrigation channel of 3 m<sup>3</sup>/sec. capacity @Rs.70,000/km works out to be Rs. 7 lakhs.
4. **Bridges and Culverts**: Per running meter of span depending up on roadway, nature and depth of foundation, type of structure etc., for small culverts approximate cost may be taken per number.

4



## PRELIMINARY / APPROXIMATE / ABSTRACT ESTIMATE

### Various methods for different structures

5. Sewage / water supply project – On basis of per head population, also on basis of area covered
6. **Water tanks** (Over heads and under ground) – **Per liter capacity**

5

## TYPES OF ESTIMATES

### Plinth area estimate

- Prepared on basis of plinth area of building.
- Similar projects with same specification, designs, locality etc.
- External area of building (covered only)
- Approximate 30-40% area of walls can be added to the floor area in case when no detail plans are available
- In case of multistory building slab area is considered

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## TYPES OF ESTIMATES

### Cube Rate estimate

- Prepared on basis of cubical content (L x B x H) of building.
- Similar projects with same specification, designs, locality etc.
- External dimensions should be considered (height = floor to floor)
- Based on IS-3861, foundation, plinth and parapet are not considered

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## TYPES OF ESTIMATES

### Revised estimate

Prepared in case if...

1. When original sanction estimates exceeds or likely to exceeds by more than 5%
2. When the expenditure on the work exceeds or likely to exceed the amount of administrative sanction by more than 10%
3. When there are material deviation from the original proposal, even though the cost may be met from the sanction amount.

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## TYPES OF ESTIMATES

### Supplementary estimate

Prepared in case if...

1. When additional work are required to supplement the original work.
2. It is altogether a fresh estimate of new item of work.

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## TYPES OF ESTIMATES

### Supplementary & Revised estimate

Prepared in case if...

1. When work is partially abandoned and the estimate cost of remaining work is less than 95% of the original work, that is less than 95% of original sanction estimate,
2. when there are material deviation and changes in the design which may cause substantial savings in the estimate, than the amount of original estimate is revised.

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## TYPES OF ESTIMATES

### Annual repair and maintenance estimate

Prepared ...

1. It is a detail estimate of maintenance work which is required to keep the structure in proper and safe condition.
2. It also can be further classified as monsoon repair estimate, special repair estimate etc.

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## CONTINGENCIES

“Incidental expenses of miscellaneous character which can not be classified under any distinct item sub-head, yet pertain to the work as a whole.”

- It is described as Generally **3%-5% of total estimated cost is added.**
- If there is any savings against such item of work than it can be utilized to meet the expense of extra item of work.

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## WORK CHARGE ESTABLISHMENT

- **It is charged to work directly**
- During execution a certain number of work super-wisers, chaukidars, mates munshies etc are required to employed and their salaries are paid from the work charged establishments provided in the estimate.
- **1.5% to 2% is added for WCE**
- It is allotted to the **temporary staff**, their duties are terminated as and when over.
- **If their requirements arise again than fresh establishments are proposed again.**

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## TOOLS AND PLANTS

- For large construction projects a **1%-1.5% of the estimated cost** is provided in the estimate for the purchase of tools and plants Which will be required for the execution of work.
- Mostly contractor has to arrange and use his own tools and plants.

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## ELECTRIFICATION WORK

- It can be **assumed up to 8%** of total estimated cost.
- It includes Electric wiring of,
  1. Lights
  2. Fans
  3. Plug points
  4. Pendent
  5. Brackets
  6. Shades
  7. Holders
  8. Bulbs
  9. Switchboards
  10. Cut-out
- **It excludes fans.**

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## WATER SUPPLY & SANITARY WORK

- **it can be assumed up to 8%** of total estimated cost.
- Water supply works includes,
  1. Water pipe lines
  2. Bib cocks
  3. Stop cocks
  4. Fitting
  5. Overhead tanks
- Sanitary works includes,
  1. Sewer pipe lines
  2. Water closets
  3. Cisterns
  4. Fittings
  5. Intercepting Traps

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## SCHEDULE OF RATES

- It is a list of various items of works
- **Facilitates the preparation of estimate**, also serve as **guideline rates** in connection with contract agreements
- P.W.D. maintain a printed document known as SOR
- The rates are workable rates of the complete item of work including materials, transport, labour, profit etc.
- **It is prepared on the basis of rate analysis**

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## ADMINISTRATIVE APPROVALS AND SANCTIONS

- For any project or work by department sanction of **cost is required from the competent authority at first instance**
- **Approval authorizes** the department to execute the work
- **Administrative approvals denotes formal expectance** of the proposal and **after that detail design, plans and estimates are prepared** and finally the execution of work.

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## EXPENDITURE SANCTION

- Expenditure sanction means the concurrence of the government of the expenditure proposed and represents allotment of the money to meet the expenditure.
- **No expenditure can be occurred before that**
- ES means an allotment of the fund to the particular work and it is usually accorded by the Finance department.

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## TECHNICAL SANCTION

- TS means sanctioning of the detail estimates, design calculation, quantities of works, rates and cost of the work by the competent authority of the engineering department.
- After TS of the estimate is given than only execution of work can be started.
- In case of original work the counter signature of the local head of the department should be obtained in the plan and estimate before TS is accorded by the department.

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## BILL OF QUANTITIES

- It is the statement of various items of work giving the description, quantities and unit of rates.
- It is in similar format as of abstract sheet but the rate and amount columns are left blank.
- It is primarily meant to inviting tenders, and supplied to the contractor
- On the receiving of the tenders the rates and amounts are compared and awarded to suitable.

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## BILL OF QUANTITIES (TYPICAL SHEET)

| SR | Particular Item of Work     | Qty.                 | Rate | Unit      | Amount |
|----|-----------------------------|----------------------|------|-----------|--------|
| 1  | Earthwork in excavation     | 32.51 m <sup>3</sup> |      | Per Cu.mt |        |
| 2  | Earthwork In filling        | 27.48 m <sup>3</sup> |      | Per Cu.mt |        |
| 3  | Lime concrete in foundation | 11.33 m <sup>3</sup> |      | Per Cu.mt |        |

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## DAY WORK

- This term is used to denote a procedure of costing or valuing an item of work on the basis of actual labourers and materials required.
- It is used to denote such item which can not be quantified or measured like ornamental work on column in plaster.
- Contractor has to maintain a day work sheet.

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## PLINTH AREA

- Covered built up area of building at floor level of any storey.
- External dimensions of building.
- Court yard, open areas, balconies and cantilever projections are not included.
- **Following should be included in plinth area,**
  1. All floors, area of wall at the floor level excluding plinth offsets
  2. Internal shafts for sanitary installation ( < 2.0 sq.mt.)
  3. Area of porches other than cantilever

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## PLINTH AREA

- Following should not be included in plinth area,
  1. Area of loft
  2. Internal shafts for sanitary installation (>2.0 sq.mf.)
  3. Unclosed balconies
  4. Towers, turrets, domes etc. projecting above the terrace level, not forming a story
  5. Architectural bands, cornices
  6. Sunshades, vertical sun breakers or box louvers projecting out.

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## FLOOR AREA

- For obtaining a floor area following shall be included in deduction
  1. Door and other opening area
  2. Intermediate support and pillars
  3. Pilasters (projection of column or architectural work) along with walls exceeding **300sq.cm. (0.3 sq.mf.)**
  4. Flues which are within walls
- For obtaining a floor area following shall be excluded in deduction
  1. **Pilasters along with walls not exceeding 300 sq.cm. (0.3 sq.mf.)**
  2. **Fire places beyond the faces of wall**
  3. **Chula platform projecting beyond the face of wall in kitchen**

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## CIRCULATION AREA

- Area for movement
- It comprises the following
  1. Verandahs and balconies
  2. Passages and corridors
  3. Entrance halls
  4. Stair case
  5. Shafts of lifts
- It is divided in two types
  1. Horizontal circulation area (mostly 10%-15%)
  2. Vertical circulation area (mostly 4%-5%)

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## CARPET AREA

- Floor area – circulation area – other non usable area
- Carpet area of office building – 60%-75% of plinth area
- Carpet area of residential building – 50%-65% of plinth area
- Walls area of multistoried frames structure – 5%-10% of plinth area
- Walls area of ordinary structure without frame – 10%-15% of plinth area

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## UNIT 03

### EXAMPLES OF PRELIMINARY ESTIMATES

29

## NUMERICAL 01

- Prepare a preliminary estimate of a project with a total plinth area of 1500 sq.mt. for all building, given that
  1. Plinth area rate – **Rs. 950.00 sq.mt.**
  2. Extra for special architectural treatment – **1.5% of total building cost**
  3. Extra for water supply and sanitary installation – **5% of total building cost**
  4. **Extra for internal installation 14%** of total building cost
  5. **Extra for services – 6%** of total building cost
  6. **Contingencies – 3%**
  7. **Supervision charges – 8%**

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## NUMERICAL 01

| SL NO | PARTICULAR  |         | RATE        | RS. |
|-------|---|---------|-------------|-----|
| 1     | BUILDING COST (ARAE x COST)                       | 1500.00 | 950.00      |     |
| 2     | SPECIAL ARCHITECTURAL TREATMENT (1.5%)            | 0.02    |             |     |
| 3     | WATER SUPPLY AND SANOTARY INSTALLATION (5%)       | 0.05    |             |     |
| 4     | INTARNAL ELECTRICAL INSTALLATION (14%)            | 0.14    |             |     |
| 5     | OTHER INSTALLATION (6%)                           | 0.06    |             |     |
|       |   |         | TOTAL       |     |
| A     | CONTINGENCIES (3% OF OVERALL BUILDING COST)       | 0.03    |             |     |
| B     | SUPERVISION CHARGES (8% OF OVERALL BUILDING COST) | 0.08    |             |     |
|       |   |         | GRAND TOTAL |     |

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## NUMERICAL 01

| SL NO | PARTICULAR  |         | RATE        | RS.        |
|-------|---|---------|-------------|------------|
| 1     | BUILDING COST (ARAE x COST)                       | 1500.00 | 950.00      | 1425000.00 |
| 2     | SPECIAL ARCHITECTURAL TREATMENT (1.5%)            | 0.02    | 1425000.00  | 21375.00   |
| 3     | WATER SUPPLY AND SANOTARY INSTALLATION (5%)       | 0.05    | 1425000.00  | 71250.00   |
| 4     | INTARNAL ELECTRICAL INSTALLATION (14%)            | 0.14    | 1425000.00  | 199500.00  |
| 5     | OTHER INSTALLATION (6%)                           | 0.06    | 1425000.00  | 85500.00   |
|       |   |         | TOTAL       | 1802625.00 |
| A     | CONTINGENCIES (3% OF OVERALL BUILDING COST)       | 0.03    | 1802625.00  | 54078.75   |
| B     | SUPERVISION CHARGES (8% OF OVERALL BUILDING COST) | 0.08    | 1802625.00  | 144210.00  |
|       |   |         | GRAND TOTAL | 2000913.75 |

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## NUMERICAL 02

- Prepare a preliminary estimate of a four storeyed office building having a carpet area of 2000 sq.mt. for obtaining the administrative approvals of the government given the data below. It may be assumed that 30% of built-up area will be taken up by circulation space, 10% by walls.
1. Plinth area rate – Rs. 950.00 sq.mt.
  2. Extra due to deep foundation at site – 1% of total building cost
  3. Extra for special architectural treatment – 0.5% of total building cost
  4. Extra for water supply and sanitary installation - 6% of total building cost
  5. Extra for electrical installation – 12.5% of total building cost
  6. Extra for other services 5% of total building cost
  7. Contingencies – 3%
  8. Supervision charges – 8%

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## NUMERICAL 02

- Total plinth area = carpet area + circulation area + walls area
- Let us assume built up area or plinth area = X sq.mt.
- $X = \text{carpet area} + 0.30 \text{ of built-up area (circulation)} + 0.10 \text{ of built-up area (walls)}$
- $X = 2000 + 0.30X + 0.10X$
- **$X = 3333.33 \text{ sq.mt.}$**

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## NUMERICAL 02

| SL NO | PARTICULAR  |         |              | RS. |
|-------|---|---------|--------------|-----|
| 1     | BUILDING COST (ARAE x COST)                       | 3333.33 | 950.00       |     |
| 2     | EXTRA FOR DEEP FOUNDATION (1.0%)                  | 0.01    |              |     |
| 3     | SPECIAL ARCHITECTURAL TREATMENT (0.5%)            | 0.005   |              |     |
| 4     | WATER SUPPLY AND SANOTARY INSTALLATION (6%)       | 0.06    |              |     |
| 5     | INTARNAL ELECTRICAL INSTALLATION (12.5%)          | 0.125   |              |     |
| 6     | OTHER INSTALLATION (5%)                           | 0.05    |              |     |
|       |   |         | <b>TOTAL</b> |     |
| A     | CONTINGENCIES (2.5% OF OVERALL BUILDING COST)     | 0.025   |              |     |
| B     | SUPERVISION CHARGES (8% OF OVERALL BUILDING COST) | 0.08    |              |     |
|       |   |         | <b>TOTAL</b> |     |

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## NUMERICAL 02

| SL NO | PARTICULAR  |         |              | RS.               |
|-------|---|---------|--------------|-------------------|
| 1     | BUILDING COST (ARAE x COST)                       | 3333.33 | 950.00       | 3166663.50        |
| 2     | EXTRA FOR DEEP FOUNDATION (1.0%)                  | 0.01    | 3166663.50   | 31666.64          |
| 3     | SPECIAL ARCHITECTURAL TREATMENT (0.5%)            | 0.005   | 3166663.50   | 15833.32          |
| 4     | WATER SUPPLY AND SANOTARY INSTALLATION (6%)       | 0.06    | 3166663.50   | 189999.81         |
| 5     | INTARNAL ELECTRICAL INSTALLATION (12.5%)          | 0.125   | 3166663.50   | 395832.94         |
| 6     | OTHER INSTALLATION (5%)                           | 0.05    | 3166663.50   | 158333.18         |
|       |   |         | <b>TOTAL</b> | <b>3958329.38</b> |
| A     | CONTINGENCIES (2.5% OF OVERALL BUILDING COST)     | 0.025   | 3958329.38   | 98958.23          |
| B     | SUPERVISION CHARGES (8% OF OVERALL BUILDING COST) | 0.08    | 3958329.38   | 316666.35         |
|       |   |         | <b>TOTAL</b> | <b>4373953.96</b> |

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