| University of Babylon	Subject: Methods of Construction and Estimation
College of Engineering	Lecture No.: 14
Department of Civil Engineering	Lesson topic: Calculation of Constr. Materials Q.
Class: IV Stage Civil Eng. 2025-2026	Lecturer: Dr. Hassanean S.H.J. Alsharifi

Calculation of Construction Materials Quantity

Brick Work:

It is masonry produced by a bricklayer, using bricks and mortar where consists of first-class bricks laid in the cement-sand mortar specified. Further, the dimensions of clay bricks according to IQS No.25 (**7.5:11.5:24.0**) cm (i.e., **height, width, length**) before building (see figure no.1), and then it would be added "**1cm**" after building as a mortar where the dimensions become (**8.5:12.5:25.0**) cm.
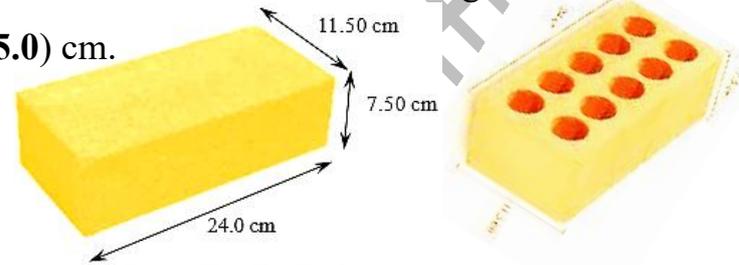
Brick work in cement mortar:

- **Cement mortar**: Cement mortar shall consist of mixture of **1:3, 1:5, or 1:6** according to the nature of work.
- **Mixing**: Cement and sand shall be thoroughly mixed dry and then water is added with a fine rose to make the mortar workable.
- *Mortar* to which the water has been added shall be used within **30 minutes** of the addition of water.
  Joints: The thickness of joints shall be regulated in addition to the vertical joints should not continue with the next row.
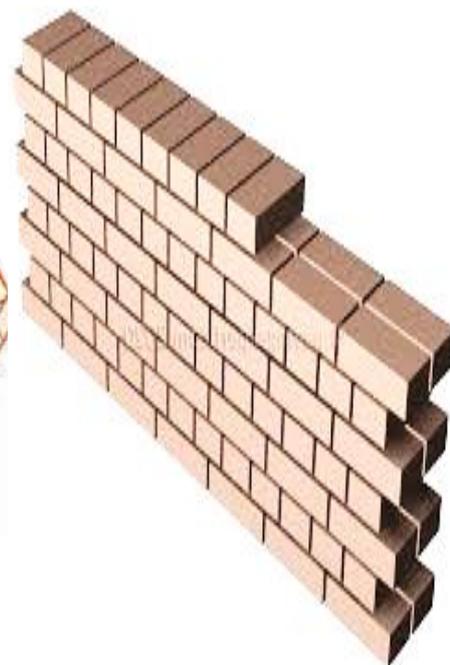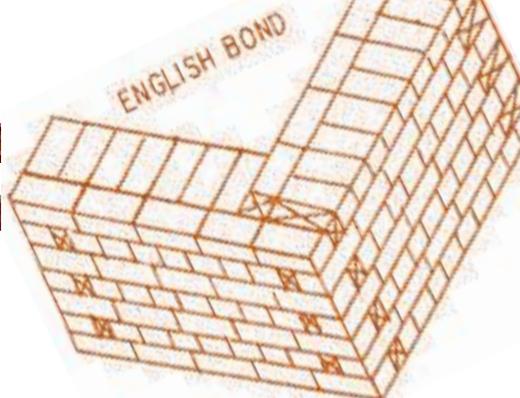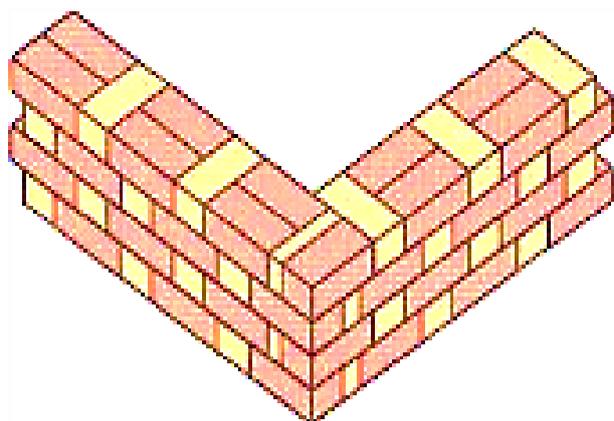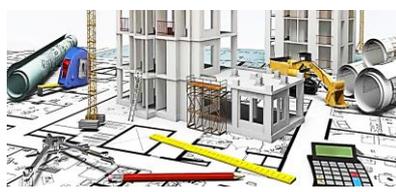
Quantity of bricks in 1m³:

$Vol. of\ brick\ after\ building\ = 0.085 \times 0.125 \times 0.25 = 0.00265\ m^3$

$No. of\ brick\ per\ 1m^3 = \left(\dfrac{1}{0.00265}\right) = 377.4 = 378\ brick$

Add **5%** as a replacement for lost and destructed

**Bricks** $= 378 \times 1.05 = 397 \approx\ \textbf{400\ brick}$

University of Babylon	Subject: Methods of Construction and Estimation
College of Engineering	Lecture No.: 14
Department of Civil Engineering	Lesson topic: Calculation of Constr. Materials Q.
Class: IV Stage Civil Eng. 2025-2026	Lecturer: Dr. Hassanean S.H.J. Alsharifi

Partition Walls

A. Thickness = 12.5 cm (half-brick)

$Apparent\ face\ of\ brick\ = 0.085 \times 0.25 = 0.02125\ m^2$

$No.\ of\ bricks\ per\ 1m^2 = \left(\dfrac{1}{0.02125}\right) = \mathbf{47\ brick}$
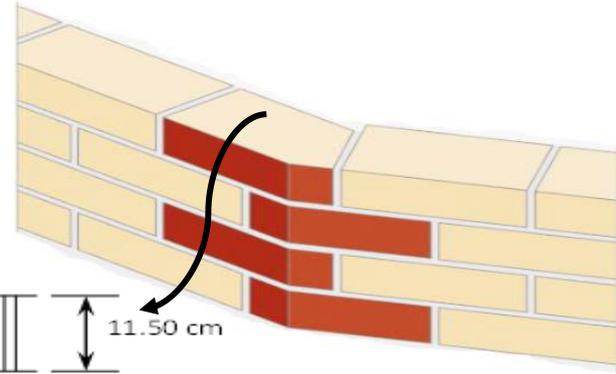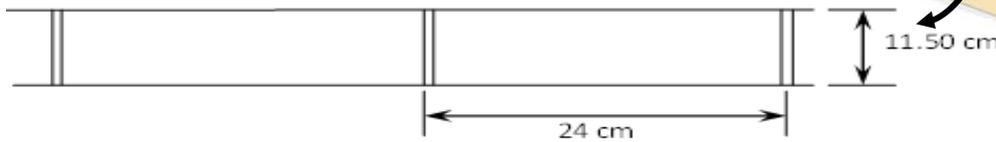
B. Thickness = 8.5 cm

$Apparent\ face\ of\ brick\ = 0.125 \times 0.25 = 0.03125\ m^2$

$No\ of\ bricks\ per\ 1m^2 = \left(\dfrac{1}{0.03125}\right) = \mathbf{32\ brick}$
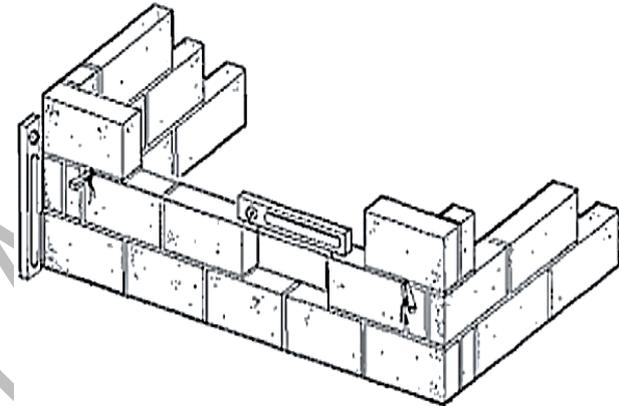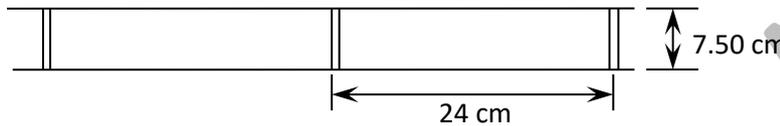
C. Arching in bricks (12.5 cm)

$Area\ of\ apperant\ face\ of\ brick = 0.085 \times 0.25 = 0.0215\ m^2$

$No.\ of\ bricks\ per\ 1\ m^2 = \mathbf{47\ brick}$

I-Section
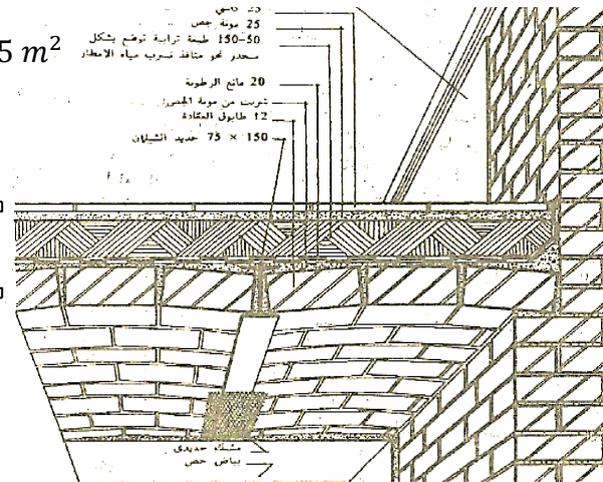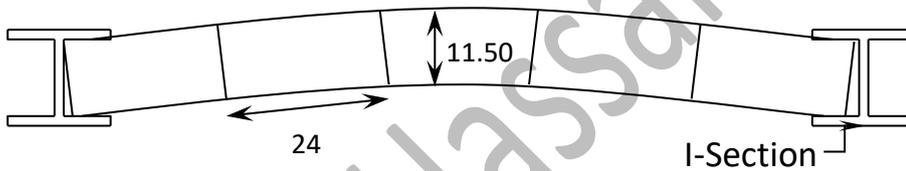
Volume of mortar used in building:

i. Cement – Sand mortar
ii. Gypsum mortar

$Vol.\ of\ brick\ before\ building = 0.075 \times 0.115 \times 0.24 = 0.00207\ m^3$

$Vol.\ of\ brick\ without\ mortar\ per\ 1m^3 = 0.00207 \times 378 = 0.78246\ m^3$

$Vol.\ of\ mortar = 1 - 0.78246 = 0.22\ m^3$

1 m³ of building from bricks and mortar

0.78 m³ bricks + **0.22 m³** mortar

University of Babylon
College of Engineering
Department of Civil Engineering
Class: IV Stage Civil Eng. 2025-2026

Subject: Methods of Construction and Estimation
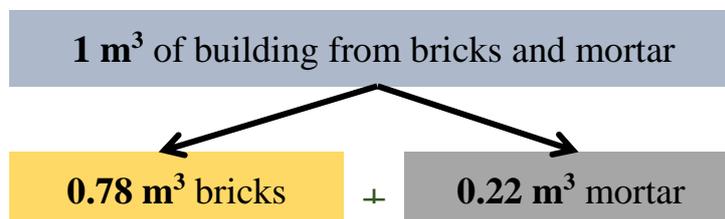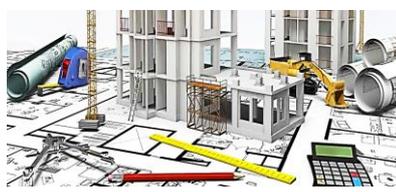*Lecture No.: 14*
Lesson topic: Calculation of Constr. Materials Q.
Lecturer: Dr. Hassanean S.H.J. Alsharifi

Calculation of the materials quantity for mortar based on mix ratio:

a. *Mortar with mix ratio (1:3) is used for Bricks building (Cement: Sand)*

The mix lost 0.25 of its volume after mixing

Volume of mortar = $0.75 \times$ Mix ratio of mortar

$0.22 = 0.75 \times (1x + 3x)$

$0.22 = 0.75 \times (4x)$

$x = \left(\frac{0.22}{3}\right) = 0.0733$

Volume of Cement = $1x = 1 \times 0.0733 = 0.0733 \ m^3$

Weight of Cement = Volume of Cement $\times$ Density of Cement

$= 0.0733 \ m^3 \times 1400 \ kg/m^3 = 102.62 = $ **103 kg per m^3 of brickwork**

Volume of Sand = $3x = 3 * 0.0733 = 0.2199 = $ **0.22 m^3 of brickwork**

b. *Quantity of Cement and Sand for rendering*

Thickness of rendering layer = *1-2 cm*

The mix lost **0.25** of its volume after mixing

Volume of mortar = $0.75 \times (Cement + Sand)$

For rendering *1m²* of layer with *2 cm* thickness and mix ratio *(1:3)*

*Volume of mortar for rendering per $1 \ m^2 = 1 \times 1 \times 0.02 = $ **0.02 m^3***

$0.02 = 0.75 \times (1x + 3x)$

$0.02 = 0.75 \times (4x)$

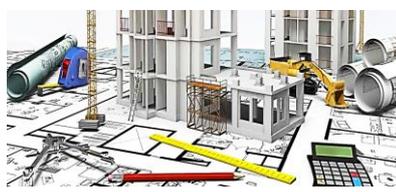$x = \left(\frac{0.02}{3}\right) = 0.0067$

Volume of Cement for rendering per $1 \ m^2 = 1x = 1 \times 0.0067 = 0.0067 \ m^3$

Weight of Cement = Volume of Cement $\times$ Bulk Density of Cement

*Weight of Cement for rendering per $1 \ m^2 = 0.0067 \ m^3 \times 1400 \ kg/m^3 = $ **9.4 kg per m^2***

*Volume of Sand for rendering per $1 \ m^2 = 3x = 3 \times 0.0067 = $ **0.02 m^3 per m^2***

University of Babylon
College of Engineering
Department of Civil Engineering
Class: IV Stage Civil Eng. 2025-2026

Subject: Methods of Construction and Estimation
Lecture No.: 14
Lesson topic: Calculation of Constr. Materials Q.
Lecturer: Dr. Hassanean S.H.J. Alsharifi

Quantity of Gypsum for plastering

Plastering consists of the fallowing layers:

i. First layer (Ordinary Gypsum) thickness $= \mathbf{2 - 3\ cm}$

Volume of plastering per $1\ \mathbf{m^2} = 1 \times 1 \times 0.02 = \mathbf{0.02\ m^3}$

Weight of gypsum for plastering $1m^2 = 0.02\ \mathbf{m^3} * 1275\ \mathbf{kg/m^3} * \left(\frac{100}{90}\right) = 28.3\ \text{kg} = \mathbf{28\ kg\ per\ m^2}$

ii. Second layer (Plaster of Paris) thickness $= \mathbf{2\ mm}$

Plaster of Paris is packed in **30 kg** per pack where e*ach* **1** pack cover approximately **20 m^2** area

Calculation of the materials quantity in Concrete based on mix ratio:

1. *Volumetric method*

$Concrete\ consisted\ cement, sand, gravel, and\ water$

$The\ mixer\ loose\ \dfrac{1}{3}\ its\ volume\ after\ mixing$

$Volume\ of\ concrete = 0.67(Cement + Sand + Garvel)$

*For mix (**1:2:4**):*

$Volume\ of\ concrete\ = 1 = 0.67(1 * Cement + 2 * Sand + 4 * Garvel)$

$Volume\ of\ concrete\ = 1 = 0.67(1x + 2x + 4x)$

$x = \dfrac{1}{0.67 \times 7} = 0.213\ m^3$

$Volume\ of\ cement = 1*x = 1*0.213 = 0.213\ m^3$

$Weight\ of\ cemet = 0.213 \times 1400 = 298 = 300kg$

$No.\ of\ cement\ packs\ per\ 1\ m^3 = \dfrac{Weight\ of\ cement}{Weight\ of\ one\ pack} = \dfrac{300}{50} = 6\ pack\ of\ 50\ kg$

$Volume\ of\ sand\ = 0.213 \times 2 = 0.42\ m^3$
$Volume\ of\ gravel = 0.213 \times 4 = 0.85\ m^3$

2. *Absolut volume method*

$\left(\dfrac{C}{density}\right) + \left(\dfrac{S}{density}\right) + \left(\dfrac{G}{density}\right) + \left(\dfrac{W}{density}\right) + v\ \% = 1$

$\left(\dfrac{C}{3150}\right) + \left(\dfrac{S}{2650}\right) + \left(\dfrac{G}{2650}\right) + \left(\dfrac{W}{1000}\right) + (2 - 4)\ \% = 1$

University of Babylon		Subject: Methods of Construction and Estimation
College of Engineering		Lecture No.: 14
Department of Civil Engineering		Lesson topic: Calculation of Constr. Materials Q.
Class: IV Stage Civil Eng. 2025-2026		Lecturer: Dr. Hassanean S.H.J. Alsharifi
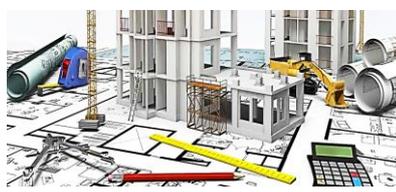
Calculation of Mosaic Tiles in $1\ m^2$:

- Tiles available in (20×20), (30×30), (40×40) and (50×50) cm, with thickness between (**2-4**) cm.
- Laying of tiles with cement mortar, joint between tiles (**2-4**) mm, as average 3 mm.

$$No.\ of\ tiles\ per\ m^2 = \left(\frac{1}{Surface\ dimension\ of\ tile}\right)$$
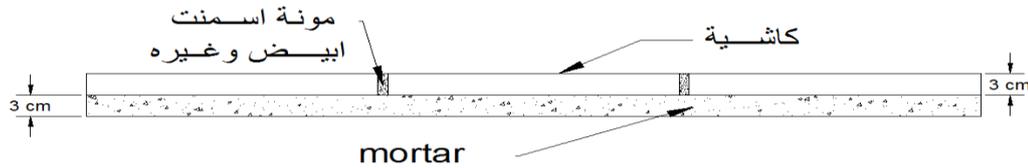
Calculation of Skirting Boards for Wall Down Edges in 1 m.l:

- It's always available in (10×30), (10×40), (10×50) cm, with thickness between (**1.-2.0**) cm.

$$No.of\ Skirting\ Boards\ per\ 1\ m.l = \left(\frac{1}{Length\ of\ one\ piece\ of\ skirting\ board}\right)$$

Calculation of Precast Concrete Flags (or slab):

- Available in $(4 \times 50 \times 50)$ cm or $(4 \times 80 \times 80)$ cm.
- Joint **2** mm.

$$No.of\ Precast\ Concrete\ Flags\ per\ 1\ m^2 = \left(\frac{1}{Area\ of\ one\ Precast\ Concrete\ Flag}\right)$$

Calculation of Concrete Pavement Bricks:

- Available in different shapes and sizes with thickness ≥ **6 cm**.

$$No.of\ Concrete\ Pavement\ Bricks\ per\ 1\ m^2 = \left(\frac{1}{Area\ of\ one\ brick}\right)$$

Calculation of Ceramics, Granit and Marble:

$$No.of\ pieces\ per\ 1\ m^2\ = \left(\frac{1}{Area\ of\ each\ one}\right)$$

- Ceramic available in packs each one is 1-1.5 m².
- Granit and Maribel available in different sizes (50×50) cm, (60×30) cm and (60×60) cm with 2-3 cm in thickness.

Calculation of Concrete Blocks:

- It is available in (20×20×40) cm, it is hollow or solid, with joint thickness 1cm.

$$No.of\ blocks = \left(\frac{1}{0.21 \times 0.21 \times 0.41}\right) = 55.3\ block\ per\ 1m^3$$

*University of Babylon*
College of Engineering
Department of Civil Engineering
Class: IV Stage Civil Eng. 2025-2026

Subject: Methods of Construction and Estimation
Lecture No.: 14
Lesson topic: Calculation of Constr. Materials Q.
Lecturer: Dr. Hassanean S.H.J. Alsharifi
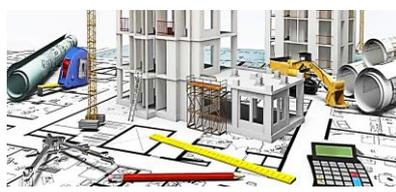
Case Study No. 14-1: Calculate the quantities of construction materials required to construct the fence, which its section and plan are shown below, if its total length (**360 m**), for the following item:

1. *Concrete (1:2:4) using SRPC for foundation where its width (0.9m).*
2. *Building is in bricks and cement mortar (1:3), under DPC, using SRPC.*
3. *Damp proof concrete (DPC) (1:2:4) using SRPC.*
4. *Building is in bricks and cement mortar (1:3), over DPC, using OPC.*
5. *Concrete (1:3:6) using OPC for cap.*
6. *Plastering of walls from both sides is with cement mortar (1:3).*

Top view of fence

Section in the fence
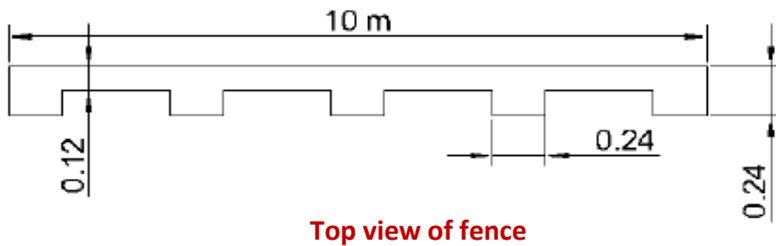
Solution:

1) **Concrete (1:2:4) using SRPC for foundation:**

$Volume\ of\ concrete\ = 360 \times 0.2 \times 0.9 = 64.8\ m^3$.

$Cement = 0.213 \times 1400 \times 64.8 = 19323.36\ kg = 19.4\ ton$

$sand\ vol. = 0.42 \times 64.8 = 27.2\ m^3$.

$gravel\ vol. = 0.85 \times 64.8 = 55\ m^3$

2) **Building in bricks and cement mortar (1:3) under DPC:**

$Vol.of\ building = \{0.48 \times 0.18 + 0.64 \times 0.24\} \times 360 = 86.4\ m^3$

$No.of\ Bricks = 400 \times 86.4 = 34560\ Brick$

$Cement\ Wt. = 103 \times 86.4 = 8899.2\ kg = 8.9\ ton$ by using SRPC
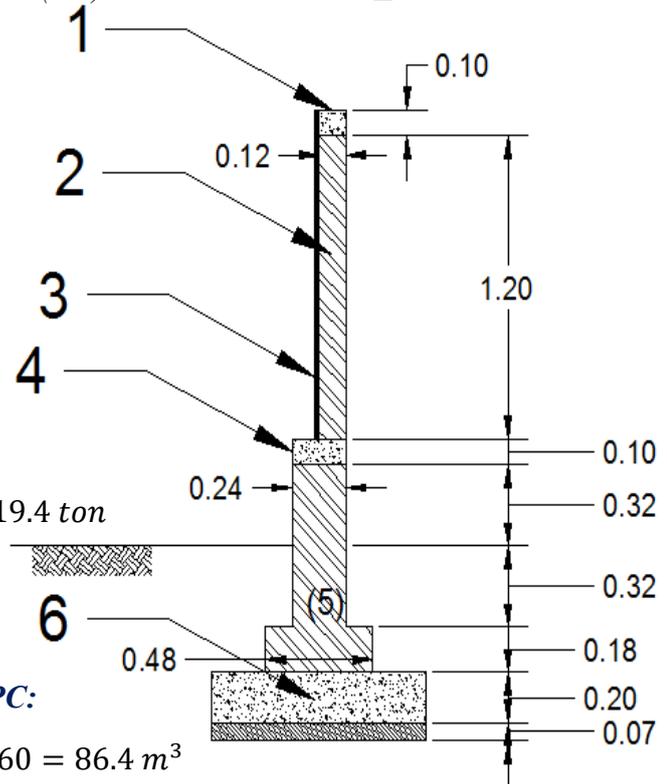
$Sand\ vol. = 0.22 \times 86.4 = 19\ m^3$

3) **DPC of concrete mix (1:2:4)**
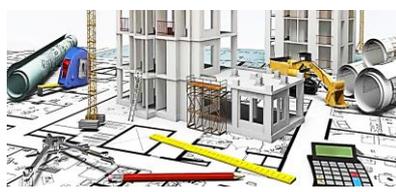
$Vol.of\ concrete = 360 \times 0.1 \times 0.24 = 8.64\ m^3$

$Cement = 0.213 \times 1400 \times 8.64 = 2576 kg = 2.58\ ton$ byusing SRPC

$sand\ vol. = 0.42 \times 8.64 = 3.65\ m^3$

$gravel\ vol. = 0.85 \times 8.64 = 7.34\ m^3$

University of Babylon		Subject: Methods of Construction and Estimation
College of Engineering		Lecture No.: 14
Department of Civil Engineering		Lesson topic: Calculation of Constr. Materials Q.
Class: IV Stage Civil Eng. 2025-2026		Lecturer: Dr. Hassanean S.H.J. Alsharifi

4) Building in bricks and cement mortar (1:3) above DPC

$$N = \left\{ \frac{360}{10} \right\} * 5 = 180.$$

$$Vol. = 0.12 \times 1.2 \times 360 + 1.2 \times 0.24 \times 0.12 * 180 = 58 \, m^3.$$

$$No. of \, bricks = 400 \times 58 = 23200 \, brick$$

$$Cement = \frac{103}{1000} \times 58 = 6 \, ton \text{ using OPC}$$

$$Sand = 0.22 \times 58 = 12.8 \, m^3$$

5) Concrete (1:3:6) mix for cap

$$Volume \, of \, concrete = 0.12 \times 0.1 \times 360 + 0.12 \times 0.24 \times 0.1 \times 180 = 4.84 m^3$$

$$1 = 0.67 \times (x + 3x + 6x)$$

$$x = 0.149$$

$$Weight \, of \, cement = 0.149 \times 1400 \frac{kg}{m^3} = 209 \, kg$$

$$Weight \, of \, tatal \, quantity of \, cement = \frac{209}{1000} \times 4.84 = 1.0 \, ton \text{ using OPC}$$

$$Volume \, of \, sand = 4.84 \times 0.149 \times 3 = 2.16 m^3$$

$$Volume \, of \, gravel = 4.84 \times 0.149 \times 6 = 4.32 \, m^3$$

6) Plastering with cement mortar

$$Area \, of \, Plastering \, below \, DPC = \{0.32 + 0.32 + 0.18 + 0.12\} \times 360 \times 2 = 676.8 \, m^2$$

$$Area \, of \, Plastering \, above \, DPC = \{1.2 \times 360\} \times 2 + 180 \times 0.24 \times 1.2 = 915.84 \, m^2$$

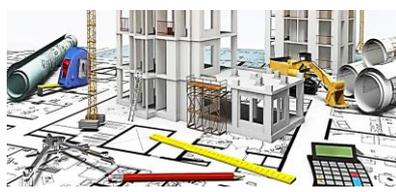$$Total \, area \, of \, Plastering = 1592.2 \, m^2.$$

$$Cement \, Wt. = 9.4 \times 676.8 = 6362 kg = 6.36 \, ton \, SRPC$$

$$Cement \, Wt. = 9.4 \times 915.84 = 8609.0 kg = 8.609 \, ton \, OPC$$

$$Sand \, vol. = 0.02 \times 1592.2 = 31.85 \, m^3$$

Material	Unit	Quantity
OPC	ton	15.6
SRPC	ton	37.24
Sand	m^3	96.66
Gravel	m^3	66.66
Bricks	unit or piece	57760

University of Babylon		*Subject: Methods of Construction and Estimation*
College of Engineering		*Lecture No.: 14*
Department of Civil Engineering		*Lesson topic: Calculation of Constr. Materials Q.*
Class: IV Stage Civil Eng. 2025-2026		*Lecturer: Dr. Hassanean S.H.J. Alsharifi*

Case Study No. 14-2: Find the quantity of construction materials required to construct the following project, shown below:

1. *Concrete for foundation (1:2:4).*
2. *Bricks building.*
3. *D.P.C by using SRPC.*
4. *Concrete for lintel as a continue beam (1:1.5:3).*
5. *Concrete for roof (1:2:4).*
6. *Mosaic Tiles for ground.*
7. *Ceramics as a wall skirting (1.2 m height).*

Section A - A

Plane View
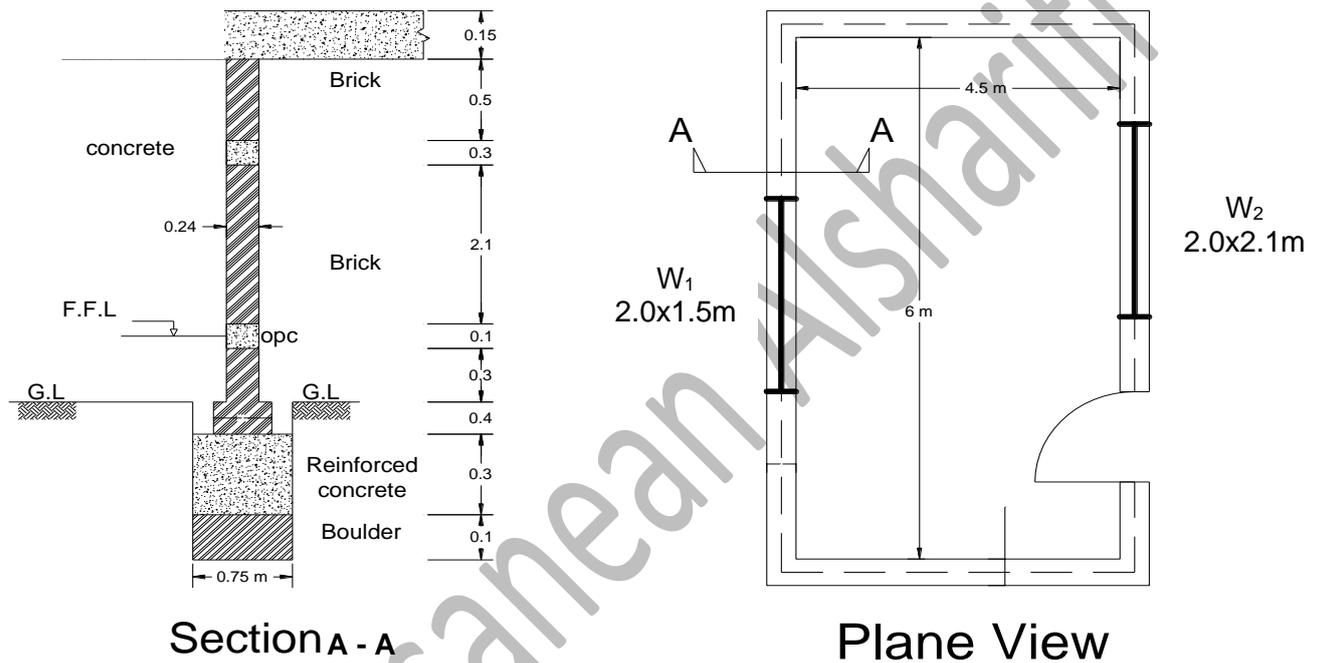
Solution:

1) **Concrete (1:2:4) using SRPC for foundation:**

   By center line method will determine the total length of footing....

   $Total\ length = \{4.74 + 6.24\} \times 2 = 21.96 = 22\ m\ , i.e.\ meter\ length$

   $Volume\ of\ concrete\ = 22 \times 0.3 \times 0.75 = 4.95\ m^3$

   $Cement = 0.213 \times 1400 \times 4.95 = 1476\ kg = 1.47\ ton$ SRPC
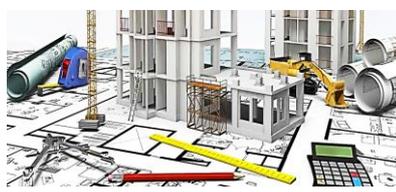
   $Sand\ vol. = 0.42 \times 4.95 = 2.1\ m^3$

   $Gravel\ vol. = 0.85 \times 4.95 = 4.2\ m^3$

2) **Building with bricks and cement mortar (1:3), under and above DPC:**

   $Vol. of\ building\ under\ DPC = \{0.4 \times 0.36 + 0.3 \times 0.24\} \times 22 = \mathbf{4.75} m^3$

   $Vol. of\ building\ above\ DPC = \{0.24 \times 2.6 \times 22\} - [0.24 \times (2 * 1.5 + 2 \times 2.1 + 1 \times 2.1) = \mathbf{11.469}\ m^3$

   $\mathbf{Total} = Brickworks\ under\ DPC + Brickworks\ above\ DPC = 4.75 + 11.496 = 16.246\ m^3$

University of Babylon
College of Engineering
Department of Civil Engineering
Class: IV Stage Civil Eng. 2025-2026

Subject: Methods of Construction and Estimation
Lecture No.: 14
Lesson topic: Calculation of Constr. Materials Q.
Lecturer: Dr. Hassanean S.H.J. Alsharifi

$No. of \ bricks = \ 400 \times 16.246 = \textbf{6499} \ brick$

$Quantity \ of \ Cement \ to \ build \ under \ DPC = \dfrac{103}{1000} \times 4.75 = \textbf{0.49} \ ton \ from \ SRPC$

$Quantity \ of \ Cement \ to \ build \ above \ DPC = \dfrac{103}{1000} \times 11.469 = \textbf{1.184} \ ton \ from \ \text{OPC}$

$Quantity \ of \ Sand \ = 0.22 \times 16.246 = \textbf{3.574} \ m^3$

3) D.P.C of concrete mix (1:2:4)

$Vol. of \ concrete = (\ 22 - 1) \times 0.1 \times 0.24 = 0.504 \ m^3$

$Quantity \ of \ Cement = 0.213 \times 1400 \times 0.504 = 150.29 \ kg = 0.15 \ ton \ from \ SRPC$

$Quantity \ of \ Sand \ vol. = 0.42 \times 0.504 = 0.21 \ m^3$

$Quantity \ of \ Gravel \ vol. = 0.85 \times 0.504 = 0.43 \ m^3$

4) Concrete (1:1.5:3) using OPC for Lintel

$Vol. of \ concrete = \ 22 \times 0.3 \times 0.24 = 1.58 \ m^3$

$1 = 0.67 \times (1x + 1.5x + 3x)$

$x = Cement = 0.27, \qquad 1.5x = Sand = 0.41, \qquad 3x = Gravel = 0.81$

$Quantity \ of \ Cement = 0.27 \times 1400 \times 1.58 = 597.5 \ kg = 0.597 \ ton \ from \ \text{OPC}$

$Quantity \ of \ Sand \ vol. = 0.41 \times 1.58 = 0.65 \ m^3$

$Quantity \ of \ Gravel \ vol. = 0.81 \times 1.58 = 1.27 \ m^3$

5) Concrete (1:2:4) using OPC for Roof

$Volume \ of \ concrete = \ 4.98 \times 6.48 \times 0.15 = 4.841 \ m^3$

$Quantity \ of \ Cement = 0.213 \times 1400 \times 4.841 = 1444 \ kg = 1.44 \ ton \ from \ OPC$

$Quantity \ of \ Sand \ vol. = 0.42 \times 4.841 = 2.03 \ m^3$

$Quantity \ of \ Gravel \ vol. = 0.85 \times 4.841 = 4.11 \ m^3$

6) Tiles for Ground Flooring with mortar (1:3) and thickness 3cm
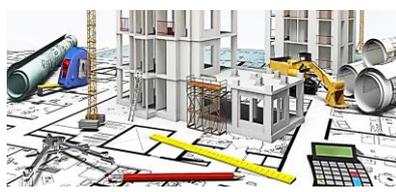
$Area = 6 \times 4.5 + 1 * 0.25 = 27.25 \ m^2$

$No. of \ Tiles \ assume \ using \ (50 * 50) cm \ Tiles$

$No. of \ Tiles = \ 27.25/0.503 \times 0.503 = 107.7 = 108 \ Tile$

$Volume \ of \ cement \ mortar = 0.03 \times 27.25 = 0.81 \ m^3$

$Quantity \ of \ Cement = 0.01 \times 1400 \times 27.25 = 381.5 \ kg = 0.382 \ \text{ton} \ from \ SRPC$
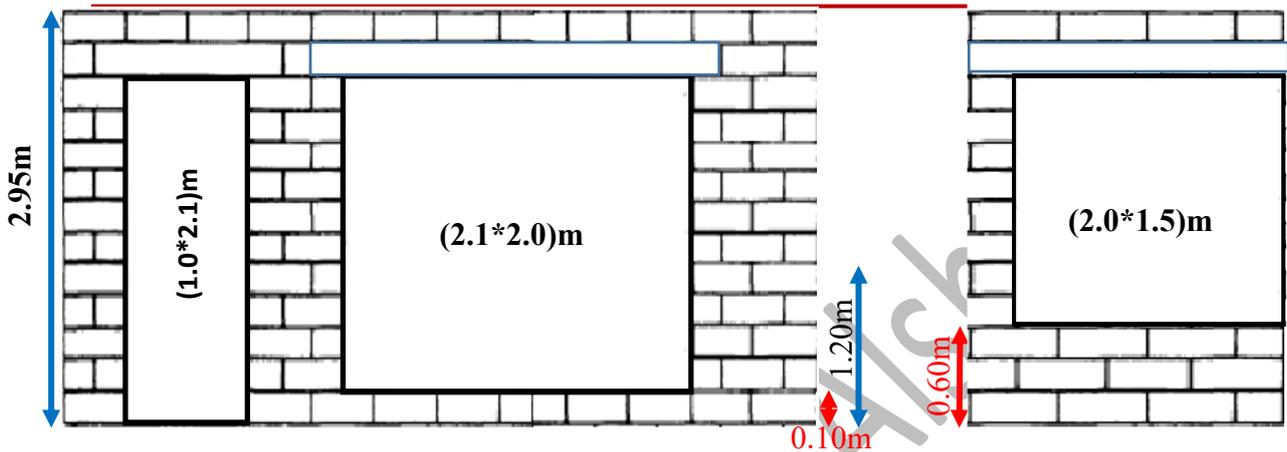
$Quantity \ of \ Sand = 0.03 \times 27.25 = 0.82 \ m^3$

7) Ceramics for Walls with mortar (1:2) and thickness 2cm

$$Area = [1.2 \times (2 \times (4.5 + 6))] - [(1 * 1.2) + (2.1 * 1.1) + (2 * 0.60)] + 0.15 \times$$

$$[(1.2 * 2) + (1.10 * 2) + (0.60 * 2) + 2.10 + 2.0] = 25.2 - 4.71 + 1.485 = 21.975 \approx \mathbf{22\ m^2}$$

$$Quantity\ of\ Cement = 0.0088 \times 1400 \times 21.975 = 270.73\ kg = 0.271\ ton$$

$$Quantity\ of\ Sand = 0.017 \times 21.975 = 0.374\ m^3$$

Material	Unit	Quantity
OPC	ton	?
SRPC	ton	?
Sand	m^3	?
Gravel	m^3	?
Bricks	unit or piece	?
Mosaic Tiles	unit or piece	?
Ceramics Tiles	unit or piece	?