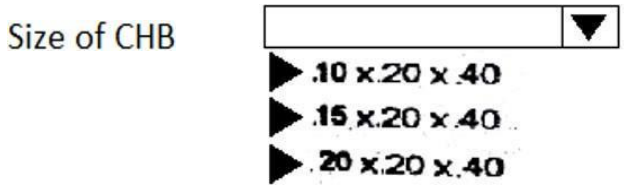
Algorithm for Masonry (Parameters)

PART 1: Concrete Hollow Blocks

Exterior Wall

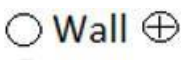
1. The user will choose the **size of CHB** which the unit is in meters.



Example:

2. The user will click the circle beside the wall (left side) and then the circle will be highlighted and the **height of wall 1** and **total length of wall 1** will appear which were the user will be going to put the dimension. Note: if there is a different dimension for the height or length of the wall, the user can click the plus button beside the wall (right side) and there will be **height of wall 2** and **total length of wall 2**, and so on.

UI:

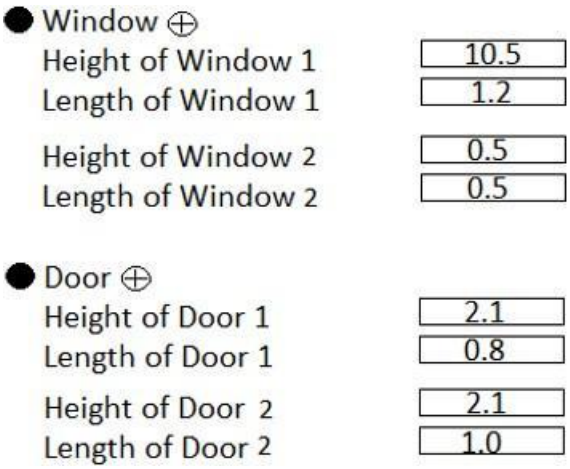


Example:

3. The procedure for windows and doors are all the same for the wall.

   UI:

   Example:



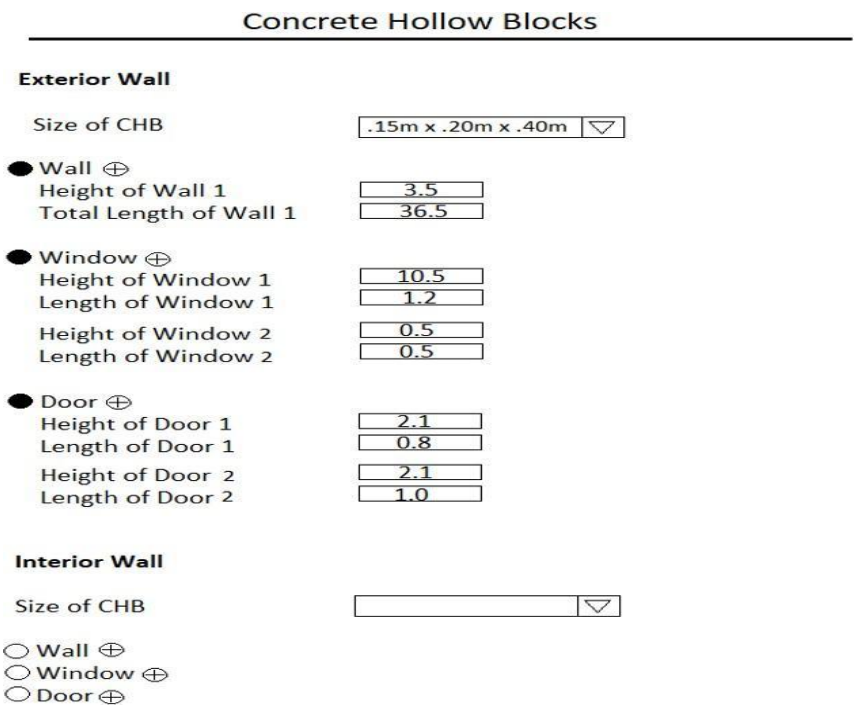
4. The results will be the **Total No. of Concrete Hollow Blocks** for the exterior wall.

Interior Wall

1. The procedure for the interior wall is all the same for the exterior wall.
2. The results will be the **Total No. of Concrete Hollow Blocks** for interior walls only.

Procedure for computing the Concrete Hollow Blocks:

Example (user's input):



Formula:

Total No. of Concrete Hollow Blocks = (pcs of CHB x .05) + (no. of CHB)

No. of Concrete Hollow Blocks = Total Area of CHB x $\frac{12.5 \text{ pcs}}{1 \text{ square meter}}$

Total Area of CHB = Total Area of Wall – Total Area of Windows - Total Area of Doors

Total Area of Wall = Area of Wall 1 + Area of Wall 2 +……. Area of Wall n

Total Area of Windows = Area of Window 1 + Area of Window 2 +……. Area of Window n

Total Area of Doors = Area of Door 1 + Area of Door 2 +……. Area of Door n

Area = Height x Length

Note: ***the exterior walls and interior walls have the same formula, but they are solved separately (not adding to each other) for they might have different sizes of CHB.***

Solution:

1. Solve for the Area of Exterior Wall

   Total Area of Wall = Area of Wall 1 + Area of Wall 2 +……. Area of Wall n

   Total Area of Wall = 36.5 x 3.5

   Total Area of Wall = 127. 75 sq. m

2. Solve for the Total Area of Windows in Exterior Wall

   Total Area of Windows = Area of Window 1 + Area of Window 2 +……. Area of Window n

   Total Area of Windows = (10.5 x 1.2) + (0.5 x 0.5)

   Total Area of Windows = 12.85 sq. m

3. Solve for the Total Area of Doors in Exterior Wall

   Total Area of Doors = Area of Door 1 + Area of Door 2 +……. Area of Door n

   Total Area of Doors = (2.1 x 0.8) + (2.1 x 1.0)

   Total Area of Doors = 3.78 sq. m

4. Solve for the Area of CHB of Exterior Wall

   Total Area of CHB = 127. 75 - 12.85 - 3.78

   Total Area of CHB = 111.12 sq. m

5. Solve for the No. of Concrete Hollow Blocks for Exterior Wall

   No. of Concrete Hollow Blocks = Total Area of CHB x $\frac{12.5 \text{ pcs}}{\text{sq.meter}}$

   No. of Concrete Hollow Blocks = 111.12 sq. m x $\frac{12.5 \text{ pcs}}{\text{sq.meter}}$

No. of Concrete Hollow Blocks = 1389 pcs. - .15m x .20m x .40m

6. **Add the factor of safety (5%)** to the solved no. of CHB for Exterior walls

   Total No. of Concrete Hollow Blocks = (pcs of CHB x .05) + (no. of CHB)

   Total No. of Concrete Hollow Blocks = (1389 x .05) + (1389)

   Total No. of Concrete Hollow Blocks = 1458.45 pcs (round-up)

   Total No. of Concrete Hollow Blocks = 1459 pcs. - .15m x .20m x .40m

TOTAL COST OF CHB: (EXTERIOR WALLS)

No. of (.15m x .20m x .40m) CHBs : 1459 pcs (@22php each)
= 1459 x 22 = **P 32,098.00**

Say for example, **INTERIOR WALLS** having the same inputs and computation (in this example only) but different in CHB dimension:

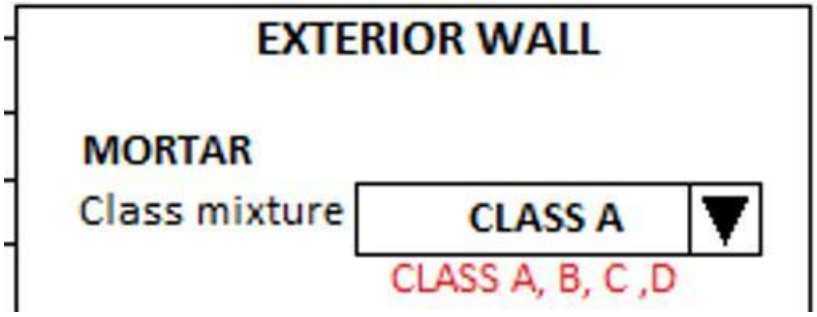
No. of (.10m x .20m x .40m) CHBs : 1459 pcs (@20php each)
= 1459 x 20 = **P 29,180.00**

PART 2: Cement Mortar

Exterior Wall

1. The user will choose a class **mixture** (Class **A, B**, **C** or **D**) for the **exterior wall** for mortar.

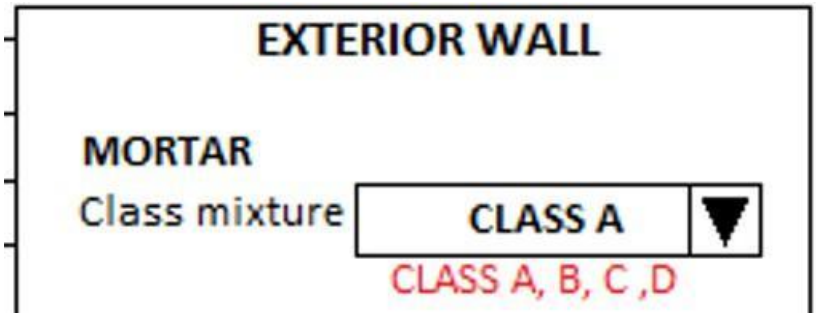
   Example:



Interior Wall

1. The user will choose a class **mixture** (Class **A, B**, **C** or **D**) for the interior **wall** for mortar.

Procedure for computing the Cement Mortar:



Formula:

Cement = (Area of CHB) x (**Bag Mixture Cement** According to Its **Size** and **Class**)

Sand = (Area of CHB) x (**Sand cu.** m According to Its **Size**)

Note: ***the cement mortar for exterior walls and interior walls has the same formula, but they are solved separately (not adding to each other) for they might have different sizes of CHB.***

Solution:

1. Solve for Cement.

   Cement = (Area of CHB) x (Bag Mixture Cement According to Its Size and Class)

   Note: to know the ***Bag Mixture Cement According to Its Size and Class*** *see table below. Since the* ***Size of CHB in meters*** *is* ***.15 x .20 x .40 meter*** *and the* ***bag cement mixture*** *is* ***Class B****, therefore the* ***Bag Mixture Cement According to Its Size and Class*** *is* ***1.018 meters.***

TABLE 2-2 QUANTITY OF CEMENT AND SAND FOR CHB MORTAR PER SQUARE METER

Size of CHB in m.	Number per sq. m	Bags Cement Mixture				
		A	B	C	D	Sand cu. m
.10 x.20 x.40	12.5	.792	.522	.394	.328	.0435
.15 x.20 x.40	12.5	1.526	1.018	.763	.633	.0844
.20 x.20 x.40	12.5	2.260	1.500	1.125	.938	.1250

Cement = (111.12) x (1.018)

Cement = 113.12016 (round- up)

Cement = 114 bags (@165 each; 114 x 165 = P 18,810.00)

2. Solve for Sand.

   Sand = (Area of CHB) x (Sand cu. m According to Its Size)

   *Note: to know the **Sand cup. m According to Its Size and Class** see table below. Since the **Size of CHB in meters** is **.15 x .20 x .40 meter,** therefore the **Sand cu. m According to Its Size** is **.0844***

TABLE 2-2 QUANTITY OF CEMENT AND SAND FOR CHB MORTAR PER SQUARE METER

Size of CHB in m.	Number per sq. m	Bags Cement Mixture				
		A	B	C	D	Sand cu. m
.10 x.20 x.40	12.5	.792	.522	.394	.328	.0435
.15 x.20 x.40	12.5	1.526	1.018	.763	.633	.0844
.20 x.20 x.40	12.5	2.260	1.500	1.125	.938	.1250

Sand = (111.12) x (.0844)

Sand = 9.378528 (round- up)

Sand = 10 cu. m (@1400php /m3; 10 x 1400 = php14,000.00)

Say for example, **INTERIOR WALLS** having the same inputs and computation (in this example only) but different in CHB dimension:

CHB: ***.10 x .20 x .40 ; CLASS A***
AREA: 111.2

CEMENT= 111.2 x 0.792= 88.07 or **89 bags** (@165 each ; 89 x 165 =**P 14,685.00)**
Sand = 111.2 x 0.0435 = 4.837 or **4.9 m3** (@1400 /m3 ; 4.9 x 1400 = **P6,860.00)**

PART 3: PLASTER (SAME PROCESS FOR EXTERIOR AND INTERIOR WALLS, BUT SEPARATE RESULTS AND COMPUTATION)

I. Compute for the area of the wall

Height of Wall = 3.5m

Length of wall = 36.5 m

A= H x L = 3.5 x 36.5 = **127.75m2**

II. Compute the area for All openings

Window 1:

H= 10.5m; L = 1.2 m

A = 10.5 x 1.2 = 12.6 m2

Window 2:

H= 0.5m; L= 0.5m

A= 0.5 x 0.5 = 0.25 m2

Door 1:

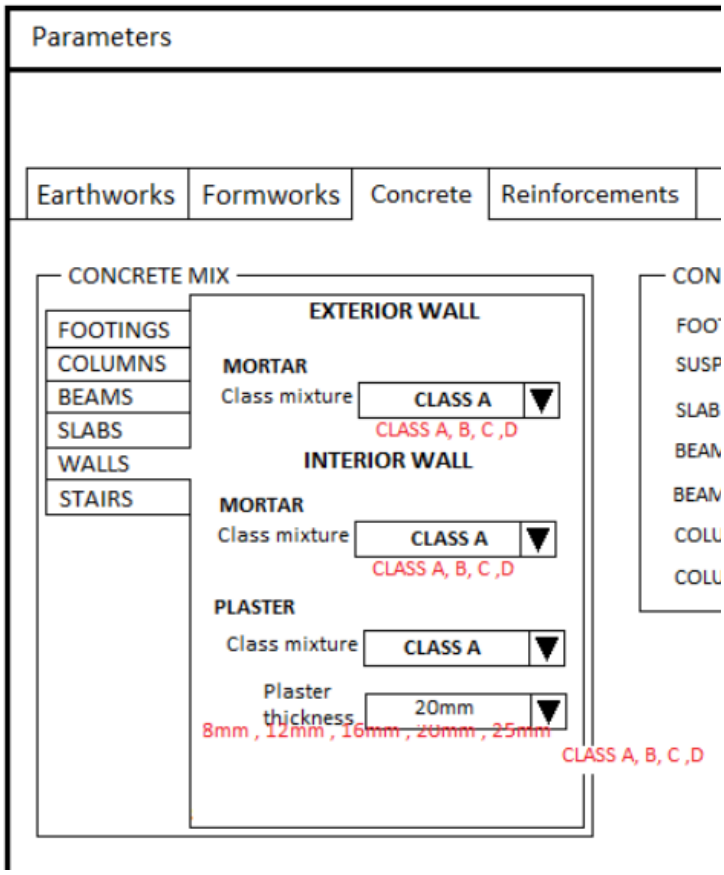
H= 2.1; L=0.8

A= 2.1 x 0.8= 1.68m2

Door 2:

H= 2.1; L=1.0

A= 2.1 x 1= 2.1 m2



Total Area of openings= 12.6+0.25+1.68+2.1 = 16.63m2

Area to be plastered = 127.75 – 16.63 = **111.12 m2**

III. Computation of volume required

User selection of thickness:

8mm, 12mm, 16mm, 20mm, 25mm

Selected thickness: 20mm = 0.02m

Selection of **Mixture class: B**

TABLE 2-1 QUANTITY OF CEMENT AND SAND FOR MORTAR AND PLASTER MIXTURE PER CUBIC METER

CLASS	MIXTURE	CEMENT in BAGS 40 kg.	SAND cu. m.
A	1:2	18.0	1.0
B	1:3	12.0	1.0
C	1:4	9.0	1.0
D	1:5	7.5	1.0

Volume = Area to be plastered x thickness

= 111.12 x 0.02 = 2.224 m3

For cement:

=2.224 m3 x 12.0 = 26.6688

(Always Multiply by 2) = 26.6688 * 2 = 53.3376 or **54 bags of 40 kg Cement**

For sand:

= 2.224 x 1.0 =2.224m3

(Always Multiply by 2) =2.224 x 2 = 4.448 OR **4.5 m3 volume of sand needed**

IV. Pricing (exterior walls)

CEMENT= 54 bags of 40kg cement x 165php = **PHP 8190.00**

SAND = 4.5 m3 x 1400.00 = **php 6300.00**

Say for example, **INTERIOR WALLS** having the same inputs and computation (in this example only) but different in CHB dimension:

Class A; area = 111.2 ; 20mm thickness

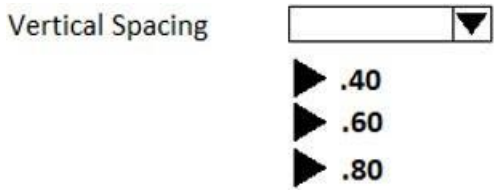
CEMENT= 54 bags of 40kg cement x 165php = **PHP 8190.00**

SAND = 4.5 m3 x 1400.00 = **php 6300.00**

PART 4: Reinforcement and Tie Wires of CHB

1. The user will choose at the default value for the **vertical spacing** which is in meters**.**

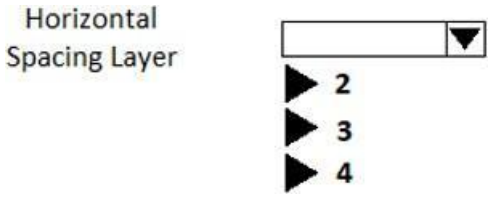
   UI:



   Example:

2. The user will choose at the default value for the **horizontal spacing layer** which are in meters**.**

   UI:



   Example:

3. The user will choose at the default value for the **rebar grade.**

UI:

Example:

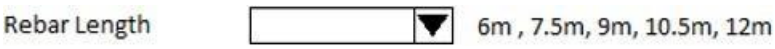
4. The user will choose at the default value for the **bar diameter.**

UI:

Example:

5. The user will choose at the default value for the **rebar length.**

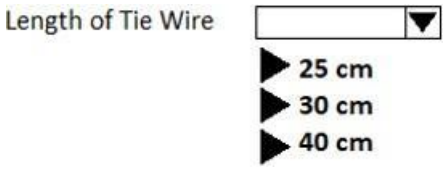
UI:



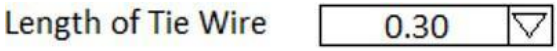
Example:

6. The user will choose at the default value for the **length of tie wire.**

UI:



Example:



Procedure for computing the Reinforcement and Tie Wires of CHB:

Example (user's input):

Reinforcement and Tie Wires of CHB

Dimension

Vertical Spacing	.80
Horizontal Spacing Layer	3
Rebar Grade	GRADE 30
Bar Diameter	10mm
Rebar Length	6m
Length of Tie Wire	0.30

Formula:

$$\text{No. of Reinforcement of CHB} = \frac{\text{Vertical Bar+Horizontal Bar}}{\textit{Rebar Length}}$$

Vertical Bar = (Area of CHB Wall) x (Vertical Reinforcement per sq. m)

Horizontal Bar = (Area of CHB Wall) x (Horizontal Reinforcement per sq. m)

Weight = N x L x m

#16 G.I Tie Wire = (Area of CHB Wall) x (kg. per sq. m of tie wire)

Solution:

1. Solve for **Vertical Bar**

   Vertical Bar = (Area of CHB Wall) x (Vertical Reinforcement per sq. m)

   Note: to solve for the vertical bar, the table ***(Length of Reinforcing Bars for CHB in Meters)*** *below is needed.* ***Neglect the Per Block,*** *for only* ***Per sq. m is needed****. Since the* ***vertical spacing*** *that the user's chose is* ***.80 meters****, therefore the vertical reinforcement per sq. m is* ***1.60 meters***

TABLE 3-5 LENGTH OF REINFORCING BARS FOR CHB IN METERS

Spacing	Vertical Reinforcement Length of bars in meter		Spacing	Horizontal Reinforcement Length of bars in meter	
m.	Per Block	Per Sq. M.	Layer	Per Block	Per Sq. M.
.40	0.235	2.93	2	0.264	3.30
.60	0.171	2.13	3	0.172	2.15
.80	0.128	1.60	4	0.138	1.72

   Vertical Bar = (111.12) x (1.60)

   Vertical Bar = 238.908 m

2. Solve for **Horizontal Bar**.

   Horizontal Bar = (Area of CHB Wall) x (Horizontal Reinforcement per sq. m)

   Note: to solve for the horizontal bar, the table ***(Length of Reinforcing Bars for CHB in Meters)*** *below is needed.* ***Neglect the Per Block,*** *for only* ***Per sq. m is needed****. Since the* ***horizontal spacing layer*** *that the user's chose is* ***3 meters****, therefore the horizontal reinforcement per sq. m is* ***2.15 meters***

TABLE 3-5 LENGTH OF REINFORCING BARS FOR CHB IN METERS

Spacing	Vertical Reinforcement Length of bars in meter		Spacing	Horizontal Reinforcement Length of bars in meter	
m.	Per Block	Per Sq. M.	Layer	Per Block	Per Sq. M.
.40	0.235	2.93	2	0.264	3.30
.60	0.171	2.13	3	0.172	2.15
.80	0.128	1.60	4	0.138	1.72

Horizontal Bar = (111.12) x (2.15)

Horizontal Bar = 238. 908 m

3. Solve for **No. of Reinforcement of CHB**.

No. of Reinforcement of CHB = $\frac{\text{Vertical Bar+Horizontal Bar}}{\textit{Rebar Length}}$

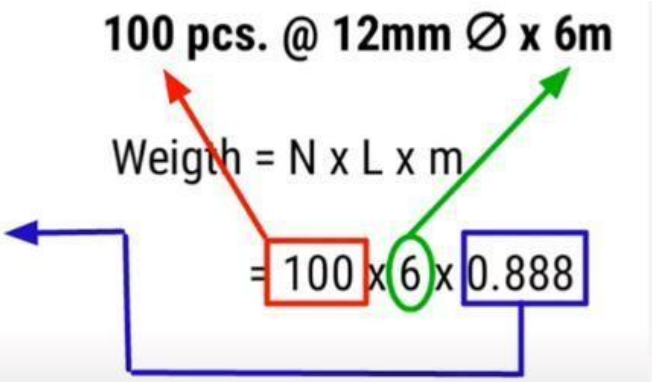
No. of Reinforcement of CHB = $\frac{177.792+238.908}{6}$

No. of Reinforcement of CHB = 69.45 (round-up)

No. of Reinforcement of CHB = 70 pcs – 10mm x 6m (Grade 30)

4. Convert the **No. of Reinforcement** of CHB into **kilograms**.

SIZE OF REBAR (DIAMETER)	WEIGHT/ METER
10	0.616 kg/m
12	0.888 kg/m
16	1.578 kg/m
20	2.466 kg/m
25	3.853 kg/m



Formula: **Weight = N x L x m**

No. of Reinforcement of CHB = 70 pcs – 10mm x 6m (Grade 30)

Weight = 70 x .616 x 6

Weight = 258.72 (round-up)

Weight of Reinforcement for CHB = 259 kg – 10mm x 6m (Grade 30)

5. Solve for **#16 G.I. Tie Wire**

#16 G.I. Tie Wire = (Area of CHB Wall) x (kg. per sq. m of tie wire)

Note: to solve for the #16 G.I Tie Wire, the table ***(No.16 G.I. Tie Wire for CHB Reinforcement Per Square Meter)*** *below is needed.* ***Neglect the Per Block,*** *for only* ***Per sq. m is needed****. Since the* ***horizontal spacing layer*** *that the user's chose is* ***3 meters****,* ***vertical spacing*** *that the user's chose is* ***.80 meters*** *and the length of tie wire that the user's chose is* ***30 cm or 0.30 m,*** *therefore the kg. per sq. m of tie wire is* ***0.24 meters***

TABLE 3-6 No. 16 G.I. TIE WIRE FOR CHB REINFORCEMENT PER SQUARE METER

Vertical Spacing	Horizontal Layer Spacing	Kilograms per Square Meter		
		25 cm. Tie	30 cm. Tie	40 cm. Tie
.40	2	.054	.065	.086
.40	3	.039	.047	.063
.40	4	.024	.029	.039
.60	2	.036	.044	.057
.60	3	.026	.032	.042
.60	4	.020	.024	.032
.80	2	.027	.033	.044
.80	3	.020	.024	.032
.80	4	.015	.018	.024

#16 G.I Tie Wire = (111.12) x (0.24)

#16 G.I Tie Wire = 2.67 kgs (round-up)

#16 G.I Tie Wire = 3 kgs.