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Construction Material Quantities in Building Units
كميات المواد الإنشائية في وحدات قياس البناء

❖ Bricks الطابوق

Brick dimensions = 7 x 11 x 23 cm **(أبعاد الطابوق حسب المواصفات)**
Brick units after building with cement mortar of 1cm (average) = 8 x 12 x 24 cm **(الأبعاد بعد البناء)**
Brick volume after building = 0.08 x 0.12 x 0.24 = 0.0023 m^3 **(حجم الطابوق بعد البناء)**
So, Number of Bricks in each one cubic meter of building = 1/0.0023 = 435 bricks **عدد الطابوق في المتر المكعب**

Finding Number of Bricks according to the wall section thickness: **حساب كمية الطابوق في قواطع البناء**

- At the 12 cm thickness: **قاطع بسمك 12 سم**
Brick face = 0.08 x 0.24 = 0.0192 m^2 **الوجه الظاهر من الطابوقة**
So, Number of Bricks in each one square meter of building = 1/0.0192 = 52 bricks (Approx.)

- At the 8 cm thickness: **قاطع بسمك 8 سم**
Brick face = 0.12 x 0.24 = 0.0288 m^2 **الوجه الظاهر من الطابوقة**
So, Number of Bricks in each one square meter of building = 1/0.0288 = 35 bricks (Approx.)

❖ Cement Mortar in 1 m^3 المونة في بناء حجم متر مكعب واحد

Brick volume before building = 0.07 x 0.11 x 0.23 = 0.00177 m^3 **(حجم الطابوق قبل البناء**
Volume of brick used in building (without mortar) = 435 x 0.00177 = 0.77 m^3 **حجم الطابوق في البناء بلا مونة**
Volume of mortar in each one cubic meter = 1 - 0.77 = 0.23 m^3 **المونة في بناء حجمه متر مكعب واحد**

❖ Gypsum Quantity in 1 m^2 of Plastering كمية الجص اللازمة لبياض جدار مساحته واحد متر مربع

Thickness of gypsum plastering = 2 cm
Volume of gypsum plastering in 1 m^2 wall face = 1 x 0.02 = 0.02 m^3
Weight of 1 m^3 of gypsum is 1275 kg (with water added) **عند أخذ متر مكعب واحد من الجص و إضافة الماء له يصبح وزنه**
So, weight of the gypsum required to plaster 1 m^2 = 0.02 x 1275 x 100/90 = 28.3 kg
ملاحظة: يفقد الجص حوالي 10 % من حجمه عند الإستعمال و إضافة الماء

❖ Quantity of Cement & Sand required for Finishing كمية السمنت و الرمل الازم للبخ 1 م^2

$$V = 0.75 (C+ S)$$

V: Volume of the cement mortar after use حجم المونة بعد الإستعمال
C; Volume of Cement حجم السمنت المستعمل في الخلطة
S: Volume of Sand حجم الرمل المستعمل في الخلطة

EX/ Estimate the weight of cement required for plastering 1 m^2 of a wall with 2 cm thickness of the mortar, which is made of cement and sand. Consider that the weight of 1 m^3 of cement is 1400 kg, for each of the following mix rates: 1- (1:3) ; 2- (1:2)

Solution:
1- Volume of 1 m^2 of mortar = 0.02 x 1 = 0.02 m^3
0.02 = 0.75 (C+3C) ⟶ C = 0.0067 m^3 ⟶ C_{weight} = 1400 x 0.0067 = 9.4 kg

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So, Volume of Sand = 3 x 0.0067 = 0.02 m^3

2- Volume of 1 m^2 of mortar = 0.02 x 1 = 0.02 m^3
0.02 = 0.75 (C+2C) ⟶ C = 0.0089 m^3 ⟶ C_{weight} = 1400 x 0.0089 = 12.5 kg
So, Volume of Sand = 3 x 0.0089 = 0.0177 m^3

❖ Quantity of Cement, Sand, and Gravel (Coarse aggregate) required to pour 1 m^3 of Concrete كمية السمنت، رمل و حصو اللازم لتجهيز 1 $م^3$ من الخرسانة

$$V = 0.67 (C+ S + A)$$

V: Volume of the cement mortar after use حجم المونة بعد الإستعمال
C; Volume of Cement حجم السمنت المستعمل في الخلطة
S: Volume of Sand حجم الرمل المستعمل في الخلطة
A: Gravel (Coarse Aggregate) حجم الحصو

EX/ Estimate the quantity of cement, sand & gravel required to pour 10 m^3 of concrete, considering that the mix rate is (1:4:8)

Solution:
10 = 0.67 (C+4C+8C) ⟶ C = 1.15 m^3 ⟶ C_{weight} = 1400 x 1.15= 1610 kg
So, for a pack of 50 kg of cement: 1610/50 = 33 packs (approx.)

S = 4 x 1.15 = 4.6 m^3
A = 8 x 1.15 = 9.2 m^3

❖ Quantity of a mixture of Sand & Gravel كمية الرمل و الحصو في 1 $م^3$ من المادتين هاتين

When 1 m^3 of sand is mixed with 1 m^3 of gravel, then the volume of this mixture will be less than 2 m^3, as the sand is filling the porous available in the gravel. This decrease differs as the volume of the mix of sand and gravel differs, taking into consideration the porous available in each. Usually, this decrease changes from 15% to 20% (17% in average).
So, with applying the following equation, the volume of each of the sand and gravel can be estimated:

عند خلط 1$م^3$ من الرمل مع 1$م^3$ من الحصى فإن حجم الخليط سيكون بأقل من مترين مكعبين و السبب هو أن حبيبات الرمل تشغل الفراغات الموجودة في الحصى، و يختلف هذا النقص بإختلاف حجم كل من الرمل و الحصى و حسب مسامية كل منهما. عادة يتراوح هذا النقص بين 15 و 20 % (17% تقريبا كمعدل)، حيث بحسب المعادلة التالية يمكن حساب حجوم الرمل و الحصى (مع إعتبار أن الحصى نصف حجم الرمل):

$$V = 0.83 (S + A)$$

S: Volume of Sand حجم الرمل المستعمل في الخلطة
A: Gravel (Coarse Aggregate) حجم الحصو

EX/ Estimate the volume of the material required to make 1 m^3 of concrete, if the rate of cement used in mix is 1 to 10 times of sand and gravel together.

Solution:
A = 2S
10 = 0.83 (S+2S) ⟶ S = 4.01 ⟶ A = 8.02
So, for each (1:10) mix ⟶ 1:4:8 (approx.)
1 = 0.67 (C+4C+8C) ⟶ C = 0.115 m^3 ⟶ S = 0.46 m^3 ⟶ A = 0.92 m^3

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❖ Number of Tiles in 1 m^2 of Terrazzo عدد الكاشي اللازم لتطبيق 1 $م^2$

The dimensions of tiles used in terrazzo flooring:

(20 x 20) cm
(25 x 25) cm
(30 x 30) cm

Taking into consideration the thickness of the joints left between each tile and another = 3 mm

Area of a (20 x 20) cm tile after application = $(20/100 + 3/100)^2$ = 0.0412 m^2
So, the number of tiles required for 1 m^2 of terrazzo = 1/0.0412 = 24.3 (use 24 tiles)

EX/ Estimate the number of (20 x 20) cm tiles required for the terrazzo of a room 6.52 m length and 4.1 m width.

Solution:
Number of tiles at the length side = 6.52/0.203 = 32.1 (use 32 tiles)
Number of tiles at the with side = 4.1/0.203 = 20.2 (use 20 tiles)

So, the total number of tiles required for the terrazzo of the whole room = 20 x 32 = 640 tiles

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EX/ estimate the quantity of cement, sand and gravel required to pour the concrete of the stair, which its plan and section are as shown below.

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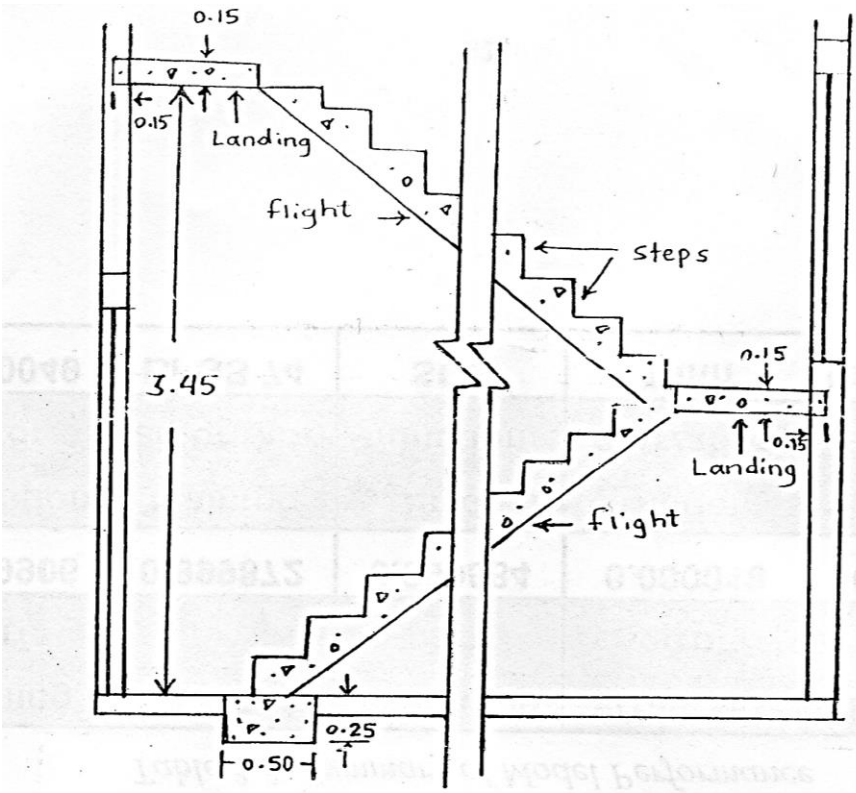
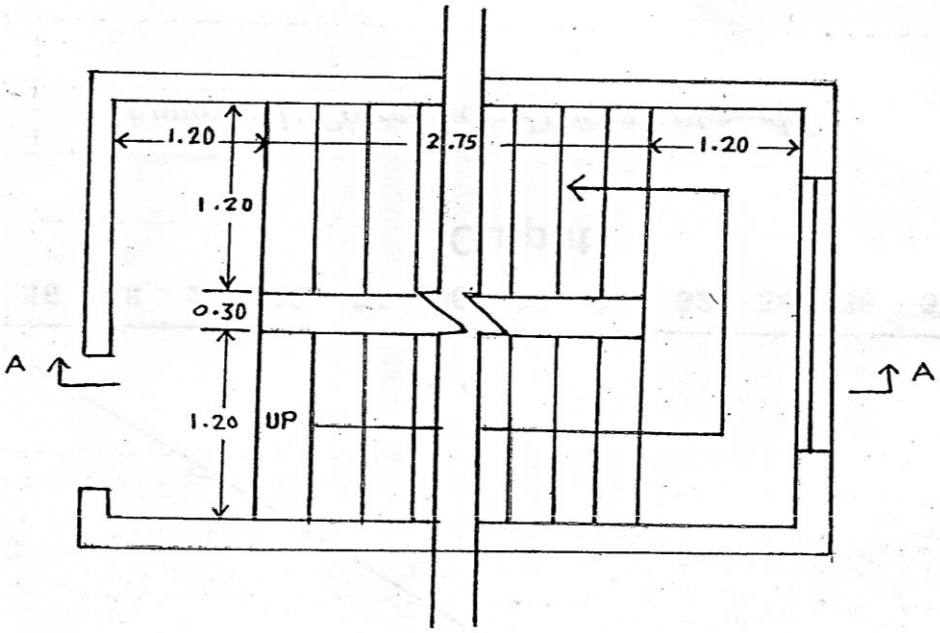


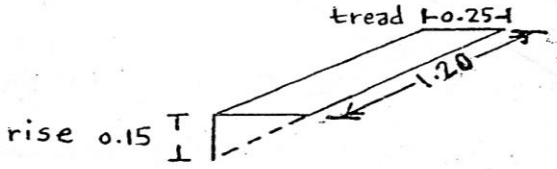
- SEC. A - A -

R.C. STAIRCAS EXAMPLE

NOTE:
- All dimension in meter unit
- Not to scale figure



- PLAN OF STAIR -



- DETAILS OF ONE STEP -