Hollow Block Slab

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Definition

Hollow block slab roof is considered the common roof used in many Arab countries, especially the Gulf. Although the main reason for using the roof as a slab in construction is to cover larger areas at the lowest cost and more safety, but it is generally used in the Gulf countries even in small spaces due to its great ability to sound insulation, as it is characterized by a large thickness that reduces noise than the regular solid roof widespread in many countries of the world. Schools in the world, for example, resort to combining the use of the hollow roof with the regular roof to reduce the high cost of construction, so the use of the hollow block or as known in field of engineering as (hollow block slab) is limited to large areas of rooms, halls, guest halls and councils, and for small spaces, the regular roof is used (solid slab).

It is a roof that consists of a group of small beams with the thickness of the roof in a specific direction that is the direction of loading and transferring the weight to the group of fallen or hidden beams and from there to the columns, the bases, the foundation soil and between these beams are the blocks, then a row of a parallel block, then a beam, and so on. The beams can be in both directions, and this method allows covering a larger area, such as large halls of more than 7 meters in width and length.

Advantages

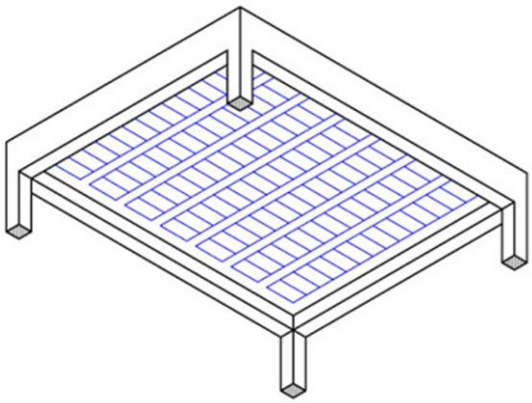
- It is characterized by more coverage of wider areas and less cost.
- It is considered as a good sound insulation.
- Hidden beams may be used that do not obstruct the architectural division (reduce columns).
- Little use of wooden molds because of lack of fallen beams.

Drawbacks

- Not preferred in places of bathrooms and kitchens.
- Higher cost compared to the regular solid roof in small spaces.
- It needs more blacksmithing work, such as reinforcing the beams (straps, upper and lower reinforcement), the upper layer of iron mesh, and making a solid part next to the fallen beams.
- A lightweight block or even Styrofoam is preferred, which increases the cost.
- After casting, longitudinal cracks may appear between the beam and the block due to the sudden change of thickness. The more the block material is close to concrete, the fewer the chances of cracks.

Calculation of Beams and Blocks

The calculation of the quantities of the hollow block slab roof of the 4 * 5 room can be divided as follows:



Calculate the number of blocks and beams.

The beams are 4 meters long because it is the smallest dimension, but what is the number of beams in this room? it is known that a number of beams and the block will be distributed in a row in a distance of 5 meters. With the starting condition in a block row and the end in a block row, we subtract the distance of the solid part from the beginning and the end if found.

Let the width of the sp be equal to 20 cm, so that the distance of the distribution of the beams and the block is equal to 4.6 meters, and by calculating:
the number of rows of the block * the width of the block + (number of beams) * the width of the beam = 4.6

By substituting the number of rows of the block equal to n, the number of beams equals n-1, and we substitute in the equation:

n * 0.4 + (n-1) * 0.15 = 4.6, where the width of the block is 40 cm and the width of the beam is 15 cm.

We calculate the number block rows, from which we count the number of beams, where the number of beams is less than the number of block stacks by one.

The number of block stacks is calculated by approximation to the nearest integer to the minus. Let the number be 8.6. We use 8 block rows and 7 beams and add the remainder to the solid bar.

The number of blocks is equal to the length of one row minus the solid bar on both sides divided by the length of the block, let it be 20 cm. So the length of the row equals 4-0.2-0.2 = 3.6 and the number of blocks equals 3.6 / .2 = 18 blocks, and by multiplying them by the number of rows, the total block is equal to 144 blocks.

Calculation of the Concrete

Suppose that the total thickness of the hollow block slab is 30 cm, so the roof can be cubed by multiplying the length times the width by the thickness, but we subtract the block cubed.

The block's cubic is equal to 144 x 0.2 x 0.2 x 0.4 = 2.3 cubic meters.

So the amount of concrete is equal to (5 x 4 x 0.3) -2.3 = 3.7 cubic meters.

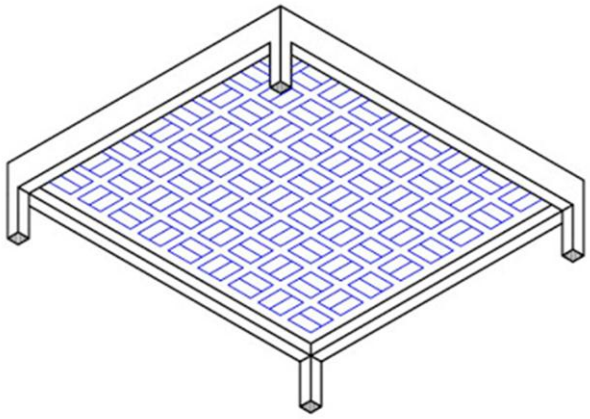
This quantity does not include the concrete of the main beams, and is calculated separately.

Calculation of the Reinforcement

The quantities of reinforcement for the beams and the solid part, as for the arming of the regular beams, are calculated according to the upper and lower armament and straps.

And these were the calculations of one way hollow block slab.

In the case of the two-way hollow block slab, there are a number of beams in the other direction to form the nerves in the form of a grid. Let us suppose that a roof whose dimensions are 7 x 7, and after subtracting the solid bar distance from both sides, the net will be 6.6 x 6.6, and the difference is in the number of total beams and the number of blocks. The blocks are stacked with 2 blocks next to each other, then a beam, and so the number of beams in both directions is equal, or a special block of size 40 x 40 x 20 is used instead of 20 x 20 x 40 x 20.



Design of Hollow Block Slab

When choosing a hollow block slab roof to cover a specific area, this roof must be designed on scientific engineering foundations to ensure the safety of the roof in use.

In the beginning, we get to know the mechanism of the work of the roof and how the transmission and flow of the load as a proper understanding of this part facilitates the correct design process.

Each of the major beams carries a weight, which it transfers to the beams and headrests, to take its path to the columns and then to the bases and the foundation soil.

This load consists of live loads such as people, furniture, etc. Dead loads are the weight of the roof itself and the weight of the finishings on it. We should not forget the weight of the block itself, as the dead load consists of the weight of the beams, the weight of the block and the weight of the top solid slab.

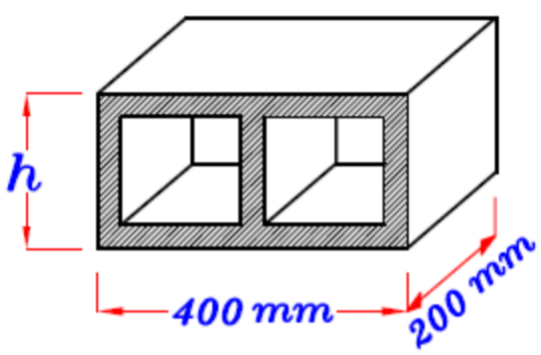
W(rib)=own weight of ribs+ ow (overall) of upper slab+ ow (overall) of blocks

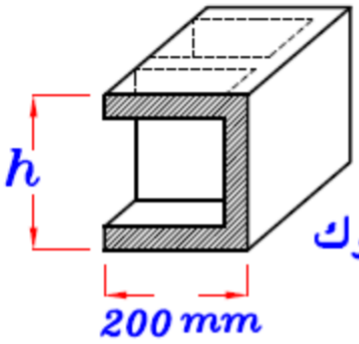
This weight is transferred to the beams after converting it to a distributed weight per meter, taking into account the loading conditions.

Used Blocks

توجد للبلوكات أحجام مختلفه أشهرها ($200 * 400 * h$)

و غالبا تكون قيمه h $\boxed{h = 150\ mm \ \text{or}\ 200\ mm \ \text{or}\ 250\ mm}$

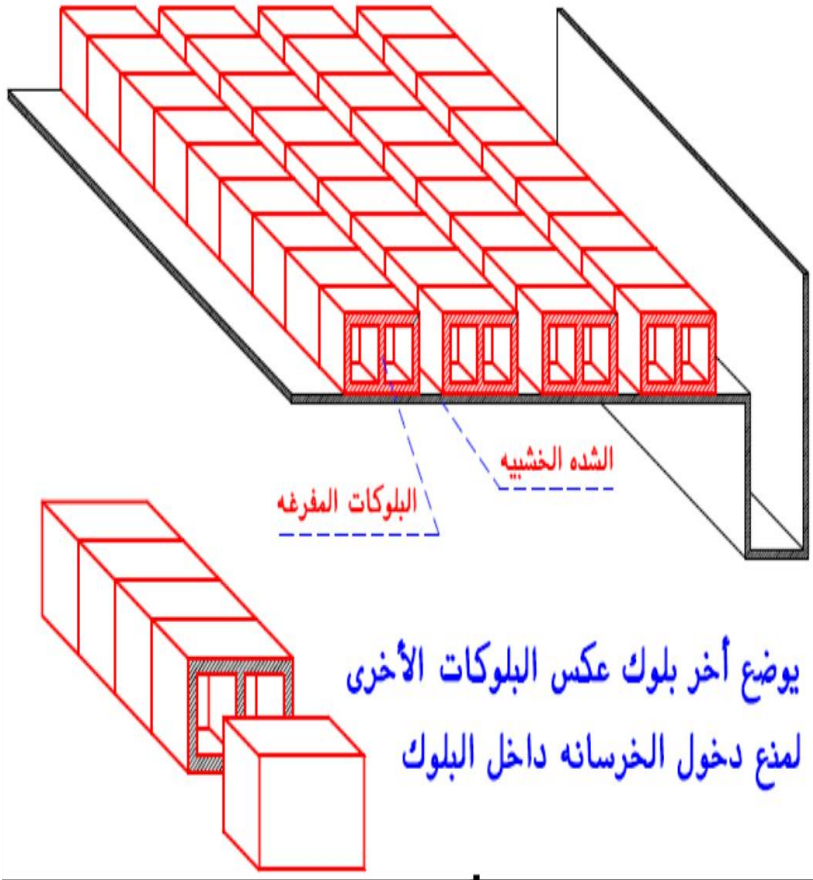




مقطع فى بلوك

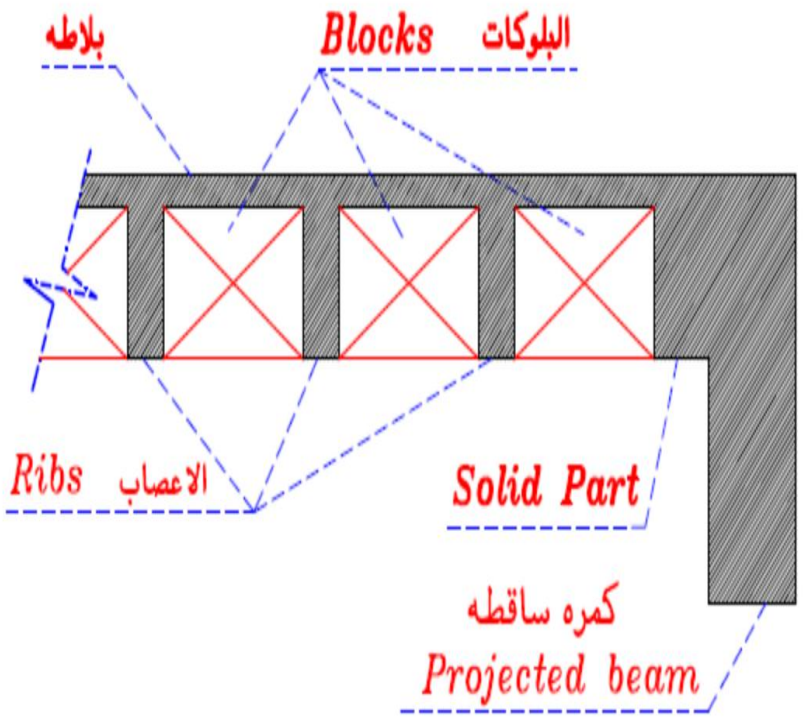
نوع ماده البلوك	ارتفاع البلوك بالمم		
	$h=150\ mm$	$h=200\ mm$	$h=250\ mm$
طوب أسمنتى مفرغ	190 N	250 N	320 N
طوب جيرى خفيف الوزن	90 N	120 N	150 N
طوب خرسانى مفرغ	140 N	190 N	240 N
طوب جيرى رملى مفرغ	170 N	220 N	280 N

شكل الشده الخشبيه و البلوكات المفرغه قبل صب الخرسانه

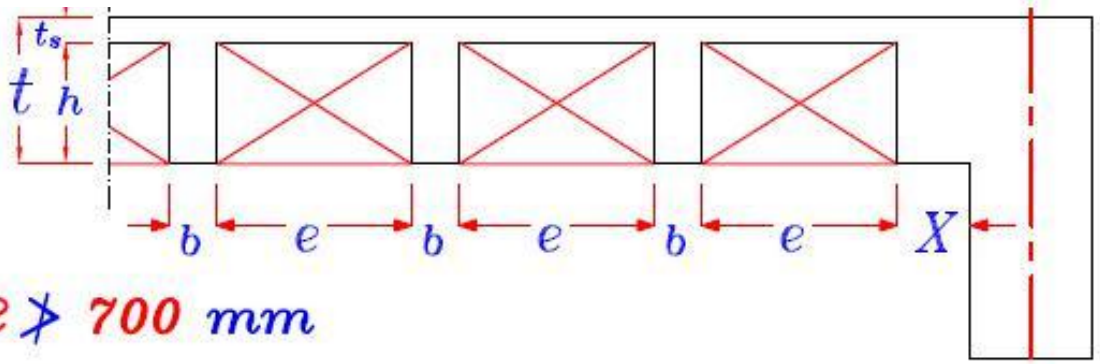


يوضع أخر بلوك عكس البلوكات الأخرى
لمنع دخول الخرسانه داخل البلوك

الأجزاء المكونه للبلاطه الـ Hollow Blocks



Dimensions of Hollow Blocks Slabs



إشتراطات الكود.

- $e \not> 700\ mm$
- $b \not< 100\ mm$, $\not< \frac{t}{3}$ } الأكبر
- $X \not< 150\ mm$
- $t_s \not< 50\ mm$, $\not< \frac{e}{10}$ } الأكبر

القيم العمليه.

$e = 400\ mm$, $b = 100\ mm$, $S = e + b$

$h = 150\ mm$ or $200\ mm$ or $250\ mm$

$t_s = 50\ mm$ or $60\ mm$ or $70\ mm$

$t = h + t_s$

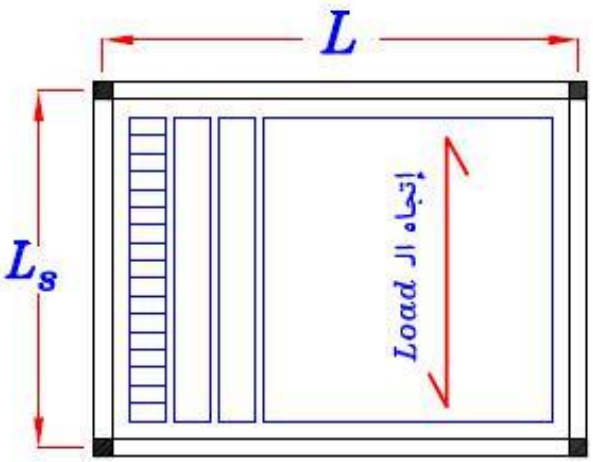
Types of H.B. Slabs

① One Way Hollow Block Slab.

One Way نستخدم بلاطه

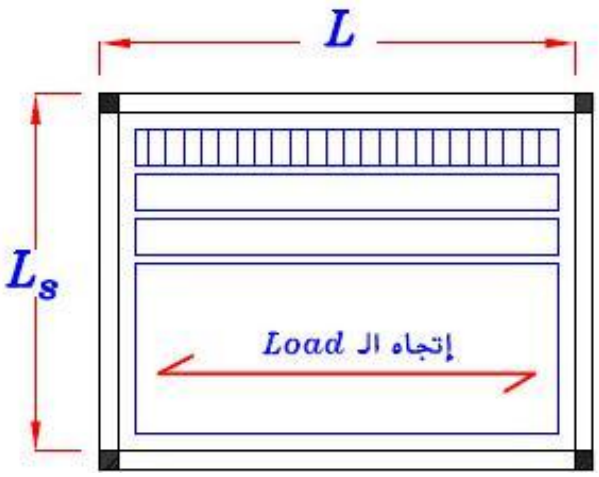
$5.0\ m < L_s \leqslant 7.0\ m$ عندما تكون

OR $L_s \leqslant 8.0\ m$, $L.L. \leqslant 1.0\ kN\backslash m^2$



ملحوظه

إتجاه ال Load هو نفس إتجاه ال ribs .



ملحوظه

لا يفضل أخذ ال ribs فى الاتجاه الطويل الا فى حالات خاصه .

② Two Way Hollow Block Slab.

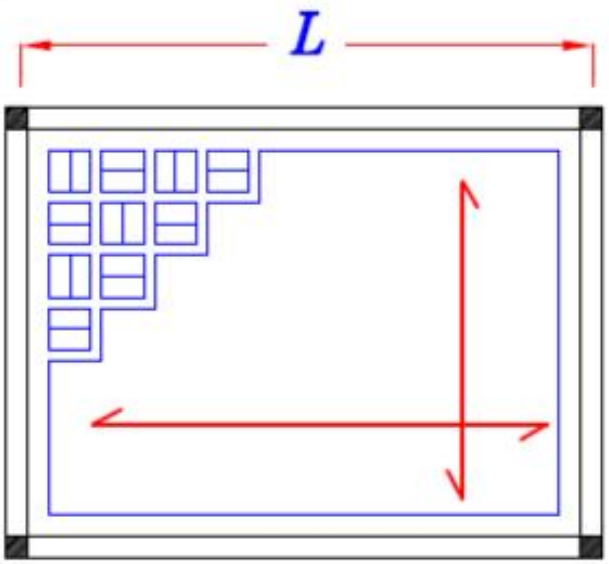
نستخدم بلاطه Two Way

عندما تكون $L_s > 7.0\,m$

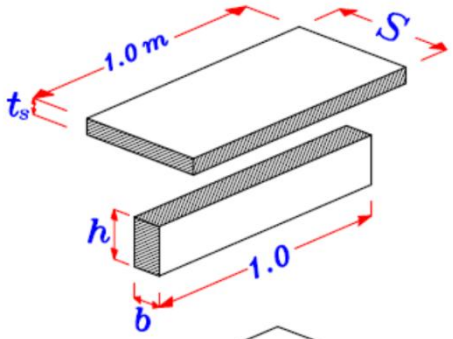
بشرط

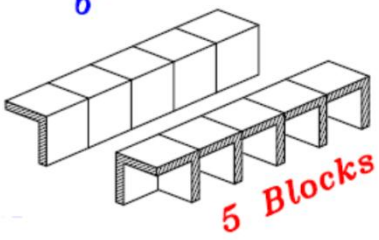
$\frac{L}{L_s} \not> 1.5$ فى الكود

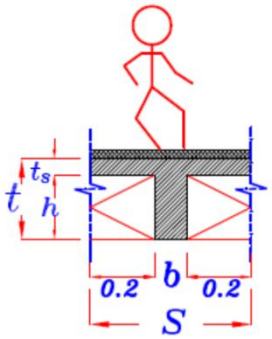
$\frac{L}{L_s} \not> \frac{4}{3}$ يفضل عملياً

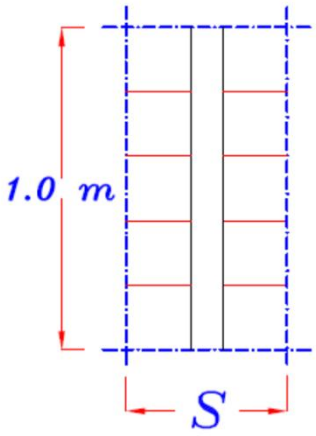


Design of One way slab









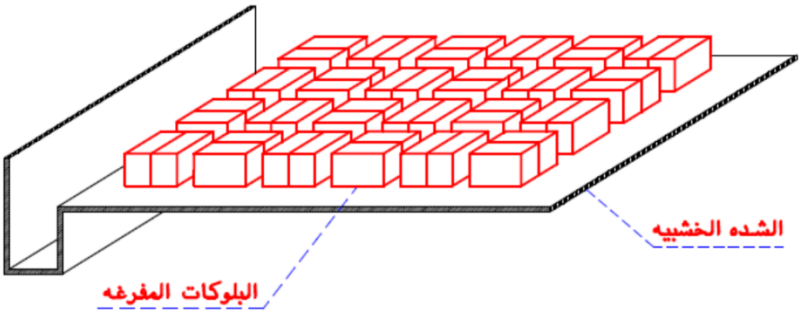
$$S = e + b = 0.4 + 0.1 = 0.5 \ m$$

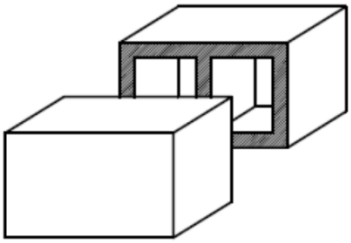
$$(w_{rib})_{U.L.} = [1.4\,(t_s\,\delta_c + F.C.) + 1.6\,(L.L.)]\,S$$
$$+ 1.4\,(b\,h * 1.0 * \delta_c) + 1.4\,[5\,(\text{Weight of One Block})]$$
$$= \checkmark\,(kN \setminus (1.0 * S\ m^2))$$

Design of Two way slab

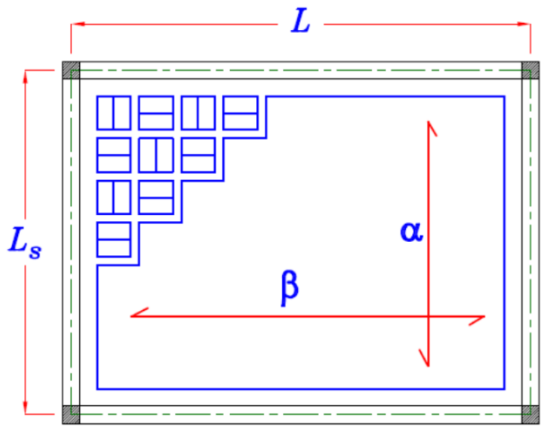
شكل الشده الخشبيه و البلوكات المفرغه قبل صب الخرسانه

Two Way Hollow Blocks Slab للبلاطه ال





يوضع البلوكين بحيث
يكون الفراغ مقابل للفراغ



نستخدم بلاطه *Two Way H.B.* عندما تكون $L_s > 7.0\ m$

بشرط

فى الكود $\frac{L}{L_s} \geq 1.5$	✓✓ يفضل عملياً $\frac{L}{L_s} \geq \frac{4}{3}$

عملياً عاده تستخدم البلاطات ال ***Two Way H.B.***
للابعاد التى تبدأ من $6.0\ m \times 6.0\ m$
أو $7.0\ m \times 7.0\ m$
أو $8.0\ m \times 8.0\ m$
أو $9.0\ m \times 9.0\ m$ ----- لا تُفضل