

## COMPARATIVE STUDY ON THE CHOICE OF BUILDING MATERIALS FOR CONSTRUCTING A HOUSE

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### Abstract

*For some, building one's own home can be a unique opportunity in a lifetime. That is why the choice of project, materials and finishings is paramount. Any homeowner wants a comfortable house, which is durable, insulated, easy to maintain, and, why not, built with least costs, but using quality materials. Brick and Autoclaved Aerated Concrete (AAC) are the most common materials on the Romanian market when it comes to building a house. Although these two materials have been on the market for years, most manufacturers still use them because of the advantages presented in time by houses constructed out of them. Brick or AAC homes have a longer life compared to the ones erected with other construction materials and feature increased safety in terms of structural strength. Also, brick or AAC houses have the advantage of much better sound insulation than wood, for example. In our country there are sufficient resources for masonry, depending on the cost invested by the owner, at the same time displaying the characteristic properties that can provide the required safety of the building. Ceramic bricks and blocks produced here have diverse sizes and shapes, being able to meet the demands of any architect and customer.*

**Key words:** brick, monolith casting, autoclaved aerated concrete, masonry, bearing walls

### INTRODUCTION

Besides the traditional and widely used pressed baked clay brick, elements of brick masonry (AAC - autoclaved aerated concrete) are also produced in our country; these blocks are widely used in bulkheads and closing walls for the buildings of reinforced concrete on frame structures [7]; as well as this, AAC is a very good insulator. Simple unreinforced masonry formed of AAC blocks is easy to achieve, thanks to the low weight blocks which is opposed to the high gauge they present. To approximate, an AAC block equates to 10 standard bricks [3].

The armed elements play a very important role in masonry structures as they have to support and counteract the horizontal and vertical forces that occur after a major sudden earthquake. Therefore the pillars, the vertical elements, and the belts, the horizontal ones, are linked together so as to compose a single and unified corpus; they all are concrete elements that transfer the energy coming from the tectonic movement, through the reinforcing steel [9]. There are sufficient

regulations in Romania that can give instructions on positioning the pillars and belts; the strict condition for pillars, as described in the picture above, is that the maximum length of the side of a wall between two reinforced pillars should not exceed 5 meters [2].

### MATERIALS AND METHODS

The disadvantages of a house built of brick / AAC stem from the low thermal comfort, the high construction costs and the lengthy building interval. The cost of the house, without painting and other features or furnishings, is given by the construction materials – 70%, and by the labor used – 30%. Since the price of materials is the main element in global cost, building the house yourself – diy – cannot cause a significant decrease in the final payment.

The masonry can be achieved in several ways, depending on the need for the structure to support without fatigue all the forces capable of generating damage to the structural bearing system. The collapse of any building should

be avoided, so, depending on the gauge of the building there can be a mandatory requirement to place masonry in a certain way; this method contributes to the load bearing capacity that the masonry wall can support. There are various methods of making it and they combine easily; the joints can be placed over along the length or the breadth of the wall.

Link joints are used in the construction of masonry in order to ensure the monolith content of the full brick masonry; it is also necessary to observe the connection among neighboring joints.

Mortar is used as binding material in the construction of masonry walls.

The mortars used in construction are well mixed compositions of binder, water and fine aggregate.

In the preparation of mortars certain additives may be used, such as: plasticizers, pigments, water proof substances, substances for adjusting the setting, hydraulic active substances, etc.

According to binders, ordinary mortars are based on lime, cement, plaster, clay earth; according to their compressive strength mortars can be: M4, M10, M25, M50, M100 (figures indicating minimum compressive strength at 28 days, in daN/cm<sup>2</sup>). For mortar M4, the compressive strength is determined at 90 days and it must be of 49 daN/cm<sup>2</sup>.

A fair design is required so as to avoid the breaking of masonry in any particular plan, especially in the elements that make up the structure of resistance.

## RESULTS AND DISCUSSIONS

### Description of the constructive material

The brick is an artificial construction material, of prism shape, obtained from a mixture of clay, sand and water or of other materials (concrete, blast furnace slag etc.), sun-dried or burned in a furnace. Unburnt bricks are called adobe.

There are two kinds of burnt clay bricks for construction:

➤ filled – due to their massiveness they provide strength to the constructions with load-bearing walls.

➤ hollow – due to the air existing in their gaps, they provide good thermal and acoustic insulation. They are used in non-bearing walls, either exterior or interior [2].

Autoclaved aerated concrete (AAC) is a lightweight precast material, being used in constructions for strengthening the structure and for insulation, as it is fire and mold resistant. AAC is produced in the form of blocks, wall panels, floor and roof panels, as well as lintels [6].

The autoclaved aerated concrete is obtained from a mixture of sand, cement, lime, gypsum, water and a gas generator, which gives the porous structure.

The material is aerated by means of a reaction between the aluminum powder and an acid, and further it is subjected to autoclaving (high temperature, high pressure steam), which cause the release of silica and quartz. The resulting AAC blocks undergo a curing process and then are cut (trimmed) in blocks of different shapes and sizes depending on their subsequent use.

### Characteristics

Construction materials present many features and properties. Some of them are important only for engineers who take them into account in the design and sizing of the various elements of a building, and others should concern all those who want to make the best decision when choosing among various materials. In this case the dilemma is “what to select: brick or AAC?”

*The characteristics for each material are as follows:*

- **The compressive strength  $R_c$ :** it is the tension ( $\sigma_c$ ) to which a material breaks down after being subjected to compression. Compressive strength is determined by standardized trials in authorized testing laboratories and it is stated in the manufacturers “declaration of conformity”.

Higher compressive strength yields higher bearing capacity, therefore smaller wall sections (which use less material), in the case

of selecting a structural system with load-bearing masonry walls [10].

If the structural system of the building is on frames (boards, beams and columns that take all forces that can be exerted on the building) or on concrete structural walls, the compressive strength of the material is irrelevant, since they do not serve a structural purpose, the only load they need to take is their own weight and the one of the finishing to be applied. [1].

- **The bulk density ( $\rho_a$ )** is the ratio between the mass of the porous solid and its apparent volume, which includes pores, cracks and any internal empty spaces. Lower bulk density means a larger volume of empty spaces or pores, hence better thermal insulation [12]. Moreover, the lower the apparent density, the lower the loads on the structural system, which, in its turn, will lead to structural elements with smaller sections and lower reinforcing steel consumption.

It is well known that the seismic force a building bears during an earthquake is commensurate with the mass of that building, so it would be ideal to construct buildings which are as light as possible, while meeting all the standards of safety and comfort.

- **The thermal conductivity ( $\lambda$ )** is the property of materials to transmit via their mass the heat flux produced by the temperature difference between two opposite sides. The thermal conductivity is characterized by the thermal conductivity coefficient ( $\lambda$ ), defined for a homogeneous flat wall, with parallel faces, by thickness ( $d$ ) and surface ( $S$ ), when there is a difference of temperature ( $t_1-t_2$ ) between the opposite faces, by the relation:

$$\lambda = (Q * d) / (S * (t_1 - t_2) * \tau) \quad [2],$$

where ( $\tau$ ) is the time interval for heat propagation. Construction materials with  $\lambda < 0.29$  are conventionally considered as thermal insulators [11].

Thermal insulation properties are also assessed by the **thermal resistance ( $R$ )**, computed by the formula:

$$R = 1/\lambda$$

The lower the thermal conductivity of a material is, the higher the thermal resistance of that material will be, so it insulates better. It means lower heat loss through a high thermal resistance wall, hence energy consumption for heating the building will decrease.

- The reaction to fire is the property of materials to temporarily withstand high temperatures (circa 1000 °C, as they occur in fires), without damage.

Table 1. Material characteristics [11]

Material Characteristics	BRICK	AAC
Compressive strength	17-22 N/mm <sup>2</sup>	1-4 N/mm <sup>2</sup>
Bulk density ( $\rho_a$ )	600-1600 kg/m <sup>3</sup>	500-700 kg/m <sup>3</sup>
Thermal conductivity	>0.18 W/mK	0.13 - 0.19 W/mK
Reaction to fire	According to the manufacturer	According to the manufacturer

(STAS 1963-73. Strength of Materials. Terminology and symbols) [11]

### Uses and dimensions

**Masonry AAC** is used to achieve load-bearing walls for buildings with reduced number of levels (Ground, Ground + 1 Floor), non-load-bearing exterior walls and partitions in tall buildings and civil engineering.

Insulation AAC is used in thermal and sound insulation of concrete panels and slabs used in blocks of flats terraces.

**A new trend** catches up, complementing and enhancing the quality of AAC. The most appreciated material by both manufacturers and customers is Ytong an almost perfect AAC. It provides great thermal comfort by eliminating thermal bridges, with zero dimensional deviations. It is natural (lime, sand) and finishing is easy, requiring a thin layer of adhesive. Ytong walls are almost perfect. It is the most expensive construction material, but the best in terms of quality. Dwellings can be made on frame metal structure, which greatly reduces the construction interval, but the projects are more difficult to design. Precast aerated AAC is a cheaper and time-saving building material.

The use of Ytong A+, AAC-type masonry, brings numerous benefits to those building themselves a house. We will present presented some data on both construction costs when using AAC Ytong A +, as compared to hollow ceramic elements, and on the subsequent requirements to heating the house.

**Saving on construction**

Considering the AAC Ytong A + price by cubic meter, it is more expensive than brick, but the material itself is not everything in building a house. In the case of Ytong A+, the cost of masonry elements is 280 lei per cubic metre, and for ceramic elements with vertical hollow spaces it is of 220 lei. However, for ceramic elements, the mortar consumption is more significant, as it fills the hollow spaces in the elements. In AAC, it is placed in a thin layer. "Using thin layer mortar reduces the thermal bridges to the minimum and the heat loss is significantly lower. When comparing Ytong A+ (35 cm) masonry to effective traditional brick (38 cm), one can see that, even if the initial purchase price per cubic meter is higher for Ytong A +, the final price per square meter of wall made of Ytong A + will be lower than the one the made with effective brick", or so they claim.

Also, one must not overlook the additional costs stemming from the building load (heavier walls cause higher costs in the composition of the resistance structure) or the construction time interval, which also involves additional costs. Furthermore, erecting a Ytong A+ square meter takes half the time. Finally, a Ytong A+ square meter 35 cm thick will cost 120-130 de lei, while the 38 cm brick one will be 150 lei.

**Lower heating costs**

In addition to this, the thermal characteristics of the AAC Ytong A+ are better than the ones of the ceramic elements. Ytong A+ walls do not require thermo-system and maintain a constant temperature, cushioning the variations outside. Such excellent insulation is obtained by means of air, the best thermal insulator there is. In Ytong A+ structure, the solid material is about 30%, and the rest up to 70% is air, retained in millions of closed pores.

Using thin layer mortar reduces the thermal

bridges to the minimum and the heat loss is significantly lower. Ytong A+ has the lowest thermal conductivity, 0.09 W/mK, while the best brick has 0.14 W/mK.

"The total cost of masonry is 4-5% of the global value of the house. So why not choose masonry materials with clear benefits: reduced construction time, thermal comfort, and lower building and maintenance costs?"

**Dimension types for AAC:**

Table 2. Dimension types for ACC [6]

Type	Width (wall thickness) b (cm)	Height h (cm)	Length L (cm)
Masonry block	15	30;35	62
	20	24;30;35	62
	24	20	62
	30	15;20	62
	35	15;20	62
Insulation block	7.5	40	62
	10	40	62
Maximum allowable tolerance	± 1mm	± 1mm	± 1mm

Building a brick or AAC house will cost 130-150 euros per square meter without painting, finishing of furnishing, and it can reach 500-550 euros per square meter when complete.

As well as this, the project of the house will cost 10-25 euros per square meter.

Depending on the speed of obtaining the construction permits, building a house with a surface of 150 square metres can be completed in 3-6 months.

**Brick**

It is used for making exterior load-bearing and non-load-bearing walls, as well as separating walls in buildings, both load-bearing and non-structural. Bricks are of several types: solid bricks; vertical hollow bricks; porous bricks for construction and thermal insulation; plywood for apparent masonry etc. Sizes of brick blocks vary according to the manufacturer. Examples of brick sizes (in mm): 40/290/238; 460/200/238; 120/290/238; 290/140/238; 290/240/138; 290/240/188; 300/240/238; 375/240/238; 375/140/188; 375/140/238; 240/115/138; 250/380/188; 290/240/188; 365/180/188; 365/180/138; 290/240/138; 290/240/138; 290/140/188;

365/115/188 [8].

**Domains for using construction materials – Brick/AAC**

The P100-2006 Seismic Design Code requirement is that the compressive strength should be of minimum 7.5 N/mm<sup>2</sup> in masonry elements for structural walls [13].

In order to be used for structure load-bearing masonry, a brick should have a compressive strength of minimum 7.5 N/mm<sup>2</sup>.

In the case of AAC, only the GBN 50 type is accepted for such use, which withstands compressions of 5 N/mm<sup>2</sup>. However, there are restrictions as to the maximum number of floors in which AAC can be used in construction.

Thus, depending on the seismic zone, the maximum levels allowed for brick or AAC is:

*A. for non-reinforced structural masonry (without pillars)*

Table 3. The maximum AAC allowed for brick in the seismic zones- for non-reinforced structural masonry (without pillars) [13]

	<b>AAC (GBN 50)</b>	<b>Brick</b>
0.08 g	ground floor	ground floor + 2 floors
0.12 g	NA	ground floor + 1 floor
0.16 g	NA	ground floor + 1 floor
0.20 g	NA	ground floor
0.24 g	NA	ground floor
0.28 g	NA	ground floor
0.32 g	NA	ground floor

[13] (Normative P100-2006)

*B. for reinforced structural masonry (confined – with pillars and belts)*

Table 4. The maximum AAC allowed for brick in the seismic zones- for reinforced structural masonry (confined – with pillars and belts) [13]

	<b>AAC (GBN 50)</b>	<b>Brick</b>
0.08 g	ground floor + 1 floor	ground floor + 4 floors
0.12 g	ground floor + 1 floor	ground floor + 4 floors
0.16 g	ground floor + 1 floor	ground floor + 3 floors
0.20 g	ground floor	ground floor + 3 floors
0.24 g	ground floor	ground floor + 2 floors
0.28 g	ground floor	ground floor + 1 floor
0.32 g	ground floor	ground floor + 1 floor

[13] (Normative P100-2006)

Normative P100-2006 further provides that, when using ceramic blocks with compressive strength greater than 10 N/mm<sup>2</sup>, and M10 mortar, the maximum number of floors can be supplemented with another one [13].

As seen from the above tables, brick has a great advantage in that more floors can be built. Also, in areas where unreinforced AAC masonry (GBN 50) is forbidden, brick can be used.

In high risk earthquake areas, reinforced structural masonry constructions (confined - with pillars and belts) are limited in the case of AAC to ground floor at most, while in the same case, using Brikston ceramic blocks, ground floor + 4floors can be reached.

If the structural system of the building consists of masonry structural walls, AAC can only be used in buildings (ground floor + 1 floor) in areas with the seismic acceleration of the ground up to 0.16g, the sizing of structural elements and the respective wall areas being carried out by the structural engineer. In this case we recommend using brick, which has much higher mechanical strength as compared to AAC.

In the case of using a frame or mixed structure system, the exterior and interior walls do not play a structural role, so they do not bear loads, and the decision on the choice of construction material, brick or AAC may be taken by the beneficiary who pays the costs.

*What masonry is?*

Building is the process by which different blocks are placed one above and / or next to each other to form walls. For this process a binder is generally used, the most common of which being the mortar based on cement and lime.

Masonry is the oldest and most common method of building house walls. Over time, masonry has been used to raise pyramids, Roman aqueducts, bridges, and, even today, with all the diverse methods to achieve structural strength of buildings, it still remains a reliable method.

Masonry blocks.

These are elements that confer resistance to a brick wall. Among the materials used, there are: burnt or unburnt full bricks, hollow bricks

of various sizes and orientations, natural stone, concrete blockets, and adobe. Various attempts have consisted of masonry made with unusual items to say the least, such as empty bottles or tires.

*Technological rules for brickwork masonry:*

- Masonry is implemented in horizontal rows running all over the building;
- Masonry is started from corners or from an empty space such as a doorway or window;
- Interruptions in masonry take the shape of steps whose height must not exceed 1 m;
- Interruptions at lintels heads is prohibited;
- Mortar is not laid on the last row;
- The first and last brick rows are made of bricks laid crosswise;
- Before work, bricks get wet with water;
- Mortar composition is given in the project and its consistency must be determined by the standard cone.

The minimum thickness of load-bearing walls is 1 brick, and, for the exterior, thermal insulation dimensions must be complied with as well.

(One)-brick walls are 25 cm thick for solid bricks, 30 cm thick, respectively, for vertical hollows bricks, and the ones (1 ½) brick are 37.5 cm thick for solid bricks and 45 cm thick for vertical hollows bricks. In what regards thermal insulation, the 37.5 cm thick wall of solid brick is equivalent to the 30 cm thick wall for vertical hollows bricks. The (1/4)-brick walls are used for partitions which do not exceed 3.50 m in height or 5 m in length, and they are made of full bricks exclusively, set on edge and having alternating joints.

#### **The binder, the material connecting the bricks**

Nowadays the most common type is the one based on lime-cement and sand. In the past, the lime-sand mortar had been widely used, and only later cement was added to the composition, due to its better performance and durability. For homes built of adobe, the binder generally used is a paste obtained by mixing yellow earth with water, and, in some cases, lime is added as well.

In performing masonry, particular attention must be paid to wall verticality and flatness. Equally important is the correct placement of

the bricks, so that each row is offset from the previous by exactly half a brick, thus avoiding the situation where two joints overlap vertically.

With the advent of modern bricks (Porothersm type), the masonry made of solid bricks has been slowly abandoned, thus significantly easing the work and increasing the end product performance.

However, it is worth remembering the important role that this kind of material, the solid brick, has had. It is sheer art to design vaults, arches, lintels, etc. using this material. Without going into further details, it should be known that all these items were made combining masonry and carpentry; first, the wooden forms were, then bricks were laid, and, after the mortar hardened, the wooden shapes were removed.

The tools used in the masonry are the trowel, the leveler, the lead thread, the rubber mallet, the masonry hammer, the saw, and the angle grinder with a diamond disc.

After finishing the foundation and before beginning the masonry, a waterproof layer should be placed over the concrete foundation, generally using bitumenised felt board or various membranes. The reason is to prevent water from the foundation to climb the wall, which occurs due to a phenomenon called capillary action.

A wall is always built throughout its length. Specifically, if you have a 20 m straight wall, the building will be done over its entire length, avoiding sections because, although it is more convenient, it can result in a meandering wall. However, there are situations where this can not be prevented. In this case, the first bricks must be placed at the extremities of the wall, throughout its length. Once the first row is laid, the building of segments can continue.

#### **Types of structure systems in buildings**

##### ***The frame structure system***

This structure system is the most widely used and best known / controlled in terms of earthquake behavior. It consists of pillars, beams and reinforced concrete slabs, such elements being designed to take all the loads

that may occur throughout the life of a building.

This type of structure system enables enough flexibility in terms of configuring the interior space of the future house, allowing openings between pillars of about 6.7 meters, or even larger.

The masonry used for this type of structure system will thus play the simple role of closing or subdividing spaces, the loads occurring in service being taken by the concrete frames. When using this type of structure system, first the beams, the pillars and the concrete slabs are made, and then the exterior and interior walls are achieved.

#### *The structure walls system*

It exists in two versions:

*(i) The structure system with reinforced concrete walls* is made of reinforced concrete slabs, beams, and reinforced concrete structural walls. These elements take the vertical and lateral loads that may occur throughout the life of the building. In the case of using this type of structure system, as well as in the case of the frame system, both exterior closing walls and interior subdivision ones, made of masonry blocks after the structure is in place, serve as non-structural elements, so take none of the loads exerted on the building.

This system is used in tall buildings where earthquake loads and gravitational forces are very strong and cannot be taken effectively by reinforced concrete frames, or it is used in constructions that require high rigidity.

*(ii) The structure system with load-bearing masonry* is used quite frequently nowadays. It is made of masonry walls with reinforced concrete seeds at the intersections of walls and additionally where needed, and perimeter belts on top of the spalet masonry. The reinforced concrete belts are poured together with the reinforced concrete slab over the previously made spalet (with pillars).

As about costs, the system is a bit cheaper than the one with reinforced concrete frames, but it has many drawbacks in terms of inside space arrangement. Thus, a home built on this type of structural system is like a box, and requires masonry spalet continuity on the next

floor, identical to those on the ground floor.

A further disadvantage is the surface of the empty spaces in the masonry walls which suffer limitations. A mixed system of reinforced concrete frames and masonry can be used to provide greater freedom in point of interior space configuration. Nevertheless, from structure perspective, this system is viewed as flawed.

A house project based on this solution (load-bearing masonry walls) will result in a space with smaller openings as compared to the solution of reinforced concrete frames, with limitations in the masonry walls gaps that will not allow future interior repartitioning without interventions on the existing structural system.

#### **The mixed system**

It comprises both the structural walls and the reinforced concrete frames. In the case of the mixed structural system of reinforced concrete frames and walls, the exterior and interior masonry walls serve a non-structural purpose. In the case of the mixed system with reinforced concrete frames and masonry walls, the exterior ones play a structural role, so they take vertical and horizontal loads.

#### **Types of walls and their role**

From the viewpoint of the loads they take, walls are divided into 2 categories: **structure walls** that take horizontal and vertical loads as well as bending moments and **non-structure walls** that take only the loads of their own weight and any loads perpendicular to their plane that may appear accidentally.

In the case of structure walls, we are interested in their bearing capacity, implicitly in the mechanical resistances of their constitutive material; depending on it all, the required areas will be sized. Brick is preferred to AAC in this case, as AAC has significantly lower compressive strength.

As for non-structure walls, their load-bearing capacity is irrelevant. Since they are erected after the structure system, they do not they take loads as the structure walls, so the choice between brick and AAC may be influenced by other criteria such as cost of materials, thermal losses (i.e. the thermal insulation that influences the cost of heating the building),

ease of construction and the time frame, sound insulation etc.

Depending on the space they separate, walls are divided into the following categories: *exterior* ones that separate the outside from the inside of the building, and *interior* walls that divide the inhabited space.

The role of external walls is to protect the inside from existing conditions outside the building (e.g. from moisture) as well as to insulate and soundproof the interior space, while the role of the internal walls is limited to sound insulation and space partitioning. Hence, for exterior walls, a material with high thermal resistance is preferable.

#### **Advantages and disadvantages of brick and AAC**

*The advantages of AAC buildings are countless.*

- The first major advantage is the fact that AAC is a natural product (the chemical composition is sand, water, cement (calcined limestone, horizontal technology), lime (calcined limestone, vertical technology).

- The second advantage is the fact that the use of 30 cm thick AAC (wide) does not require thermal insulation (saving at least 12 euro per square meter of insulation), due to the low rate of thermal loss.

- The third advantage is related to labor (fewer blocks to handle and lighter than traditional brick), which means ease of use, because the material can be sanded and cut to size easily with a circular or manual saw.

- Thermal insulation, fire proof properties and earthquake resistance are important characteristics of AAC systems.

- A further advantage of AAC is that it is a light building material with 500-700 kg/m<sup>3</sup> apparent density, which means lower loads on the structure system, which, in its turn, translates into lower reinforcement consumption for reinforcing the smaller concrete segments of the structure elements. Sections of reinforcement required for structural reinforcement are proportional to the loads that these elements should take. It is also well known that the seismic force acting on a building is commensurate to its mass, so the more lightweight construction, the better.

- AAC contains a large number of tiny air pores, resulting in a low density and preventing excess heat transfer which creates optimal comfort with minimum costs for both heating and cooling. It can be used both for external walls (recommended thickness of 30-35 cm) and for the interior.

- AAC blocks do not absorb water in depth and do not change their mechanical and thermal insulation properties in time. In addition to this, thermal conductivity is low in any direction of the masonry block.

- The fact that AAC is up to five times lighter than concrete leads to significant reductions in CO<sub>2</sub> emissions during transport.

- AAC is a non-combustible building material, forming a barrier against the spread of fire, which also provides very good sound insulation.

- The weight of AAC masonry is considerably lower as compared to concrete or brick masonry, which makes it better withstand earthquakes.

- The very convenient quality-price ratio makes AAC an effective solution among building materials.

The downside of AAC is that it has no bearing qualities, so it is not recommended for load-bearing walls in the building.

#### ***The advantages of brick***

If you decide to build a brick house, you should know that the recommended ceramic blocks are "porotherm" type. This type of ceramic blocks is provided with a vertical hollow spaces system, providing better thermal and sound insulation as compared to the solid blocks.

As "porotherm" type ceramic blocks do not provide sufficient structure rigidity as compared to the solid ceramic ones, it is necessary to confine the masonry with belts and concrete little poles so as to meet the standards of strength and stability under the current rules.

Among the advantages of brick we list:

- proficient thermal and acoustic insulation,
- structure stability,
- seismic protection, mechanical strength superior to other materials such as AAC,

which recommends brick for load-bearing walls,

- fire proof
- non-flammable products,
- long lifespan,
- 100% natural products.

**Among the disadvantages of this material we list:**

- greater weight than AAC, hence greater loads to the structure system, the need for larger concrete sections of structure elements and larger amounts of reinforcement to use,
- weaker insulation than AAC, so it needs additional thermal insulation, which means extra costs,
- can not turn on other dimensions because it has a place in mortar
- higher costs than AAC.

## CONCLUSIONS

We can say that it is difficult to make an assessment without knowing all the details of such large jobs. The site location also counts because materials have different prices from one city to another, from one area to another, in our country. The same thing happens with the labor for construction workers whether the house will be done on your own or with a specialized building company. It is interesting to note that a cubic meter of ceramic blocks and one of AAC, similar in size and of best quality, can be purchased at almost similar prices. The decision will be taken by the beneficiary, after considering all factors intrinsic to the problem, and the available financial resources.

In conclusion, it can be seen that most of the criteria by which we can get lower prices refer to the way the building is designed, the correlation of all elements it consists of, and judicious implementation coverage of this thinking in the elements that will assist in contracting the work.

This comprehensive approach is time consuming when balancing as many as possible of the factors listed above. It is basically each one's effort in determining the needs and desires of the family members, and then comparing them to the budget.

This is when the future owners of the house practically reconsider their way of life and lifestyles, the short and long term plans, and the affordable financial effort in realistic calculation. All this is reflected in the housing project.

The true cornerstone of a house cannot be found somewhere in the foundation, but in the cooperation with specialists qualified to carry out the project and, more than that, to guide us in our approach.

A house is a complex of factors that influence each other. Thus, an aspect dealt with superficially involves the burden of an additional cost elsewhere, if not necessarily in another execution phase, maybe in an operational phase or in capitalization.

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