

## **A THEORETICAL ANALYSIS OF THERMO- STONE'S BENEFITS COMPARED TO BRICKS AND OTHER FREQUENTLY USED BUILDING MATERIALS IN IRAQ**

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### **Abstract**

According to the current study, the country urgently needs to build many housing units due to the country's growing population. This shift in the housing and construction industry mainly depends on the availability of substitute building materials with high-quality specifications, long lifespans, and reasonable costs. The cost of housing units has significantly increased due to my country's economic woes, economic crises, and rapid population growth (the population will reach roughly 40 million by 2030). The purpose of this study is to concentrate on the properties of thermo-stone Positive to construct units in Iraq that have good specifications, are ecologically benign, can be implemented quickly, and are less expensive than conventional materials. The study's conclusions were focused on some factors: lightweight, thermal and acoustic insulation, construction cost , resistant to moisture , speed of construction and Other building features.

**Keywords:** Population growth, high durability, thermo-stone, affordability, Benefits of Construction, and Materials Used Frequently in Iraq.

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## Introduction

There is no denying that the country's urgent need for a large number of housing units and the country's growing population demands a revitalization and shift in the housing and construction sector. This sector primarily depends on the availability of alternative construction materials with high-quality specifications, high durability, and low cost, as well as being environmentally friendly materials that help reduce the use of energy and it is produced in a way that reduces the use of energy. In addition to offering and developing cutting-edge construction approaches characterized by reduced implementation costs and times. The use of green engineering and sustainability concepts in structural engineering. It is accomplished by increasing the scientific and cultural awareness of specialized organizations and universities, adopting new scientific practices for professional practice in implementing and exploiting clean energy resources and minimizing the waste of energy, water, and materials used during construction processes. Even though Iraq is an oil-producing nation, its economic woes and low living standards have made it urgently necessary to find new, affordable building materials with desirable properties such as lightweight, density, rapid implementation, and other traits.

## Problem Statement and Aims

The cost of housing units has significantly increased due to my country's economic woes, economic crises, and rapid population growth (the population will reach roughly 40 million by 2030). As a result, he studied building materials known for their rapid implementation and low cost, leaving conventional materials. This detailed study came to concentrate on the thermo-stone Positive's qualities to construct units in Iraq that are well-specified, environmentally friendly, quick to install, and affordable compared to the traditional building materials.

## Thermo-Stone:

A lightweight precast cellular concrete called Thermo-stone is made of cement, sand, and water. It can be manufactured by mixing small amounts of lime, gypsum, and aluminum powder. It was created in Sweden.



### **Density:**

Thermo-stone is distinguished by its lightweight, with a density of (600-800) kg/m<sup>3</sup>, which lowers the cost of construction and uses fewer foundation volumes.

The following table compares the density and weight of thermo-stone with other conventional Iraqi building materials. Table I and Figure (1)

TABLE(1)

Density kg/m <sup>3</sup>	The materials	types
2400	concrete	1
1400-1500	bricks	2
1600	Hollow concrete bricks	3
2000	solid concrete bricks	4
500-600	Thermo-Stone Blocks	5
1400	Red bricks	6

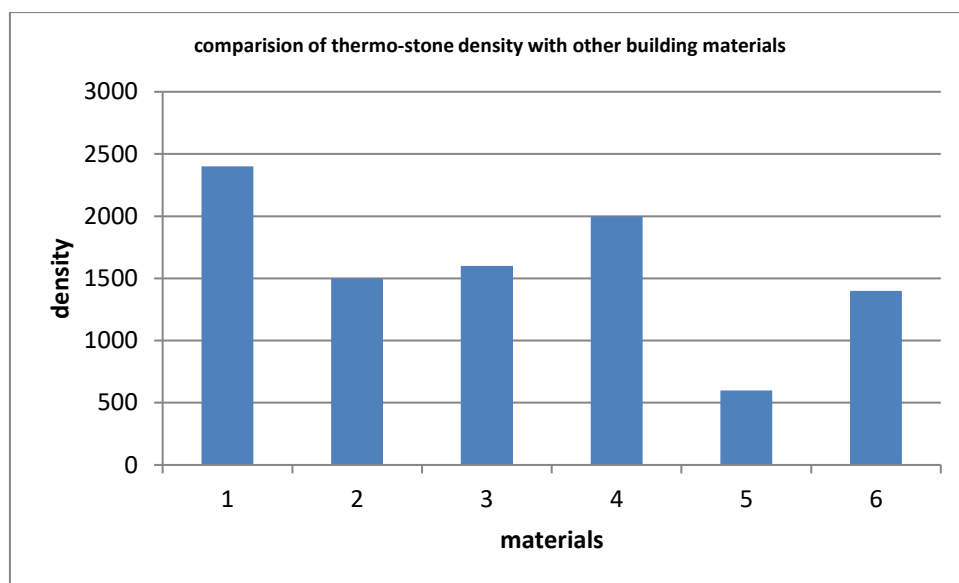


Figure (1)

Thermo-stone is distinguished by its lightweight, with a density of (600–800) kg/cm<sup>3</sup>, which lowers the cost of construction and uses fewer foundation volumes. Decrease the structural weight as well. There are a lot of weights on the foundations and columns.

### Thermal Insulation

Due to the air bubbles in its mass, it has good acoustic and thermal insulation properties. The degree of thermal insulation is dependent on the thermal conductivity coefficient. Air bubbles give light concrete its excellent direct insulation, which helps to conserve electrical energy, given that it is one of the material's most crucial characteristics. According to the accompanying table (2) and figure (2), which compare Thermo-thermal stone's conductivity coefficient to those of the other materials, Thermo-stone is thought to be the best thermal insulator of the earlier materials. Building a wall with a thickness of 24 cm is similar to building a wall of

standard bricks with a thickness of 36 cm because of the thermo-excellent stone's thermal insulation characteristic. As a result, it reduces costs and energy needed for cooling and heating, especially considering Iraq's environment, which has a significant impact.

TABLE(2)

(R, m <sup>2</sup> .hr.°C/kcal) thermal conductivity coefficient	The materials	types
1.41	concrete	1
0.53	bricks	2
0.6	Hollow concrete bricks	3
1	solid concrete bricks	4
0.23	Thermo-Stone Blocks	5
0.4	Red bricks	6

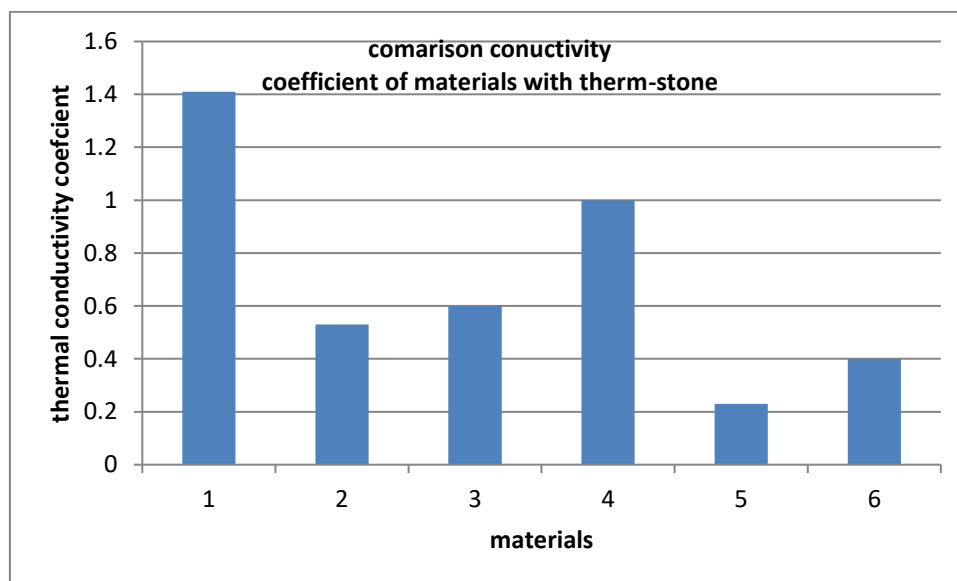


Figure (2)

### Sound Insulation

A wall made of thermo-stone has the unique capacity to insulate sound better than regular brick; for instance, a wall 24 cm thick is equivalent to a wall 64 cm thick made of regular bricks. The researcher claims that air bubbles are to blame for this.

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### **Resistant to Moisture**

Thermo-stone is resistant to moisture and water absorption because the internal air holes are closed; its absorbability is up to (5-10) mm over 72 hours as opposed to 210 mm during 5.3 hours for regular bricks. In other words, bricks absorb 285 times more than thermo-stone. According to the researcher, the air bubbles in the thermo-stone are closed and not attached to one another, which is why this is happening.

### **Salt Content**

The sand used in thermostone installations is well cleansed and free of salts to the allowable limits allowed by the standard criteria. The most significant flaw in bricks is their high salt content, which makes them, unlike bricks.

### **Expansion Coefficient: -**

Compared to other building materials, thermo-stone has a low expansion coefficient (0.34 mm/m). In other words, in the researcher's opinion, it is favored over other building materials like bricks since it is a fixed-size substance that changes little with temperature changes.

### **Work Completion Speed:**

Due to its lightweight and colossal size, thermo-stone construction may be completed much more quickly than with regular bricks; although it takes (5-7) hours to construct 1 m<sup>3</sup> of bricks, it only takes 3 hours to do it with thermo-stone. Thermo-stone thus gets precedence over other materials like bricks.

### **The economy in Cement Mortar: -**

Ordinary brick construction uses 27% m<sup>3</sup> of cement or plaster mortar per cubic meter, but thermo-stone construction uses 7% m<sup>3</sup> and the same volume with a 1:4 mixing ratio.

Thus, the construction cost is significantly reduced.

### **Compressive Strength**

The thermo-stone may be used to build three to four floors without needing concrete since, despite its small weight, it has good compressive strength. Despite having a lower compressive strength than bricks and other materials, thermo-stone has a compressive strength of 5 N/ m<sup>2</sup>, compared to bricks' 18 N/ m<sup>2</sup> and concrete blocks' 13 N/ m<sup>2</sup>. It is pretty pricey and light. Tables (3) and figure (3)

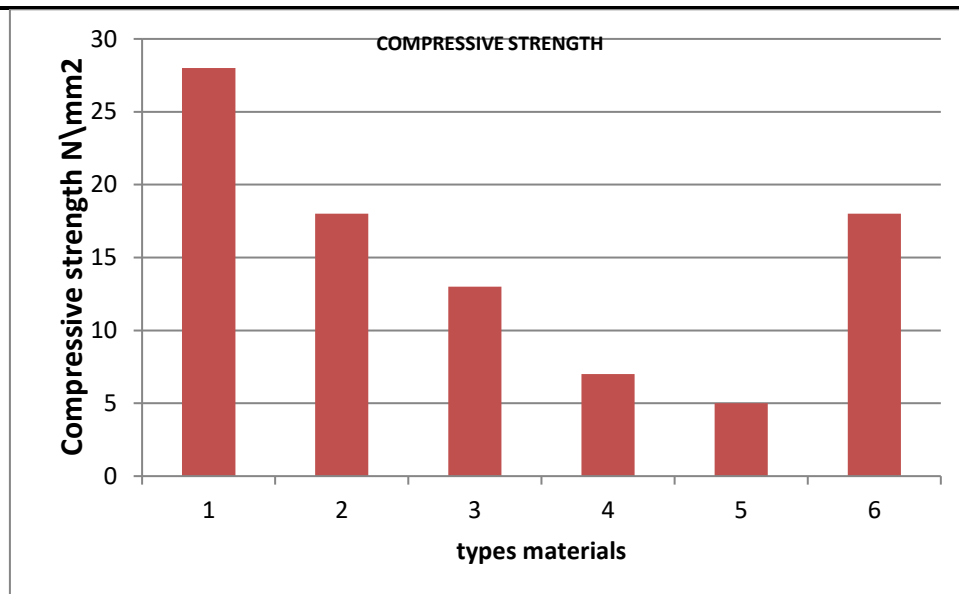


Figure (3)

Table (3)

compressive strength N/mm <sup>2</sup>	The materials	types
28	concrete	1
18	bricks	2
13	Hollow concrete bricks	3
7	solid concrete bricks	4
5	Thermo-Stone Blocks	5
18	Red bricks	6

**Water Absorbency:**

It takes 90 days for thermo-stone. 24 cm are needed for the water to reach that distance. Due to the absence of capillary channels significantly compared to the other construction materials, the Thermo-stone is in a better position. This implies that walls without finishing and 24 cm thick must be subjected to rain for 3 months for moisture to enter.

**Results**

**Lightweight:** Thermo-stone has a 600–800 kg/cubic meter density, making it lighter than bricks and other building materials. This lowers the construction cost and promotes economy in the sizes of foundations utilized during construction.

Due to the air bubbles in its mass, thermo-stone has a strong sound and thermal insulation properties. The degree of this insulation is determined by the material's



thermal conductivity coefficient, which relies on how many calories are contained in one square meter.

The thermo-stone is in a better position because of its insufficient capacity to absorb water.

The absence of salts in thermo-stone makes it superior to bricks, whose saltiness is one of their main drawbacks.

Due to its lightweight, big size, ease of forming, and lack of finishing work, thermo-stone accelerates the completion of construction projects significantly more quickly than regular bricks do.

Construction with regular bricks requires more mortar per cubic meter (cement or plaster). In contrast, construction with thermo-stone requires significantly less mortar for the same volume and at a ratio of 1:4 in favor of thermo-stone.

The economy in the foundations: The thermo-light stone's weight means that it places less stress on the foundations than other building materials like clay, lime bricks, and concrete blocks, which ultimately results in a reduction in the size of foundations built for buildings and lower expenses.

Thermo-stone has a lower compressive strength and durability than brick and other materials. Still, it is suitable because it allows for building 3–4 stories without the requirement for a supporting framework. It has the advantage because of several other positive traits.

## Conclusion

From the preceding, it was exhibited that the usage of Thermo-stone in the construction of residential units attained a decline in the cost of construction, and this could be due to its lightness in weight, low density, and speed in productivity and quality in other qualities such as sound and thermal insulation and resistance to moisture in residential buildings. Furthermore, the production of thermo-stone is considered environmentally friendly. Corresponded with traditional bricks and other materials, it represents a great resolution to the problem of fewer housing units and high prices, which is the destination required by many countries, including Iraq.

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