

**THERMAL RESISTANCE PERFORMANCE OF NATURAL STONES BY  
THERMOSTATIC OVEN AND INFRARED THERMOMETER**

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**Abstract**

*Energy crisis is a major problem faced by the country in this era. Energy utilization by people is growing now days. Also building or house which is need of every human being is contributing to global warming by emitting gases due to heat radiation. Artificial cooling is leading to increase the greenhouse gases. Expose area of building to sunlight or increasing temperature have demanded for more and more cooling system. Other reason is the climatic change happening in surrounding. To overcome this multi-dimensional path can be followed that is use of natural stones in construction. Use of Natural stones will help to reduce the energy consumption, increasing level of global warming and will keep the interior parts of room cool. Natural cooling in building contributes to reduce the size of air condition system and annual energy consumption. It is very essential for energy saving; a growing interest is focused on using building stones. There are certain applications where this heat transfer or thermal conductivity and other characteristics of a natural stone become an important factor in selecting the best material and design. Also Ecological way can be preferred to have minimal carbon footprint in construction and multidimensional development. The naturally available and economic material can be used to partially replace the artificial products which harm the environment. The above method may be used for natural air conditioning in buildings and can be efficient in reducing global warming. Properties of natural stone samples used in building construction were studied and their temperature was measured by using thermostatic oven and infra-red thermometer and results were manipulated.*

**Keywords:** *Temperature measuring gun, Thermostatic oven, Basalt with applied oil paint (yellow), Red granite, White and black marbles.*

**Introduction**

During the previous couple of years the terribly topical theme is that the renovation of previous buildings and building-up of latest energy potency buildings. a number of the explanations that provoke the humanity to begin to assume therein direction square measure the worldwide warming of the world and as a result the unfavourable environmental condition changes. Brobdingnagian a part of natural resources is employed for energy production and transmission, and this is often forever in the middle of loading of ecological system and potential risks for the long run. the most indicators that every advanced product designed for trade, transport and households should meet square measure value, energy potency and environmental friendliness. The energy potency is that the most vital since it determinates the chances and terms for payment of the merchandise at its future mistreatment and therefore the aggressiveness of the producing within which it participate. the utilization of other building materials whose thermal characteristics square measure comparable those of the advanced materials is one in all the ways that to extend the energy potency of buildings. A reason these materials to be environmentally friendly is that almost all of them return entirely from it, this implies that they are doing not colly it and will be used repeatedly thought operating. different benefits of the choice building materials are: work with them is long and it's not required special qualification to use them; usually they might be extracted directly from the place which can be increase, that the transporting emissions square measure reduced; thermal characteristics of some various building materials show that they're applicable at totally different temperature ranges as a result of they need superb insulating properties.

From the preceding it's clear that the dynamic conditions and needs of the rules impose continues search of latest solutions. According of varied makers of building materials, thermal physical phenomenon constant of the offered by them product is in wide ranges. coupled to the expected large flow of the environmentally friendly building materials within the follow, it's necessary to manage their declared parameters and specially the thermal physical phenomenon constant. A comparative analysis of the experimental results of thermal physical phenomenon measurements of environmentally friendly building materials is delineate.

## **Materials and Methods**

There is variety of natural stone used in construction. But we will deal with some common stone use in construction such as basalt, lateritic, marble and granite.

### **Marble**

Granular sedimentary rock or dolomite (i.e., rock composed of calcium-magnesium carbonate) that has been recrystallized below the influence of warmth, pressure, and liquid solutions. Commercially, it includes all ornamental calcium-rich rocks which will be polished, still as sure serpentines. Marbles typically occur interbedded with such metamorphic rocks as mineral schist's, phyllites, gneisses, and granulites and area unit most typical within the older layers of Earth's crust that are deeply buried in regions of maximum folding and igneous intrusion. The amendment from sedimentary rock made in fossils into true marbles in such metamorphic regions may be a common phenomenon; often, as at Carrara, Italy, and at port, Norway, recrystallization of the rock has not fully destroyed the organic structures. Metamorphic rocks area unit one amongst 3 main varieties. the opposite 2 primary kinds of rocks area unit igneous rocks and matter rocks. Igneous rocks area unit fashioned by the cooling and curing of volcanic rock or stone.



**Figure 1: Marble**

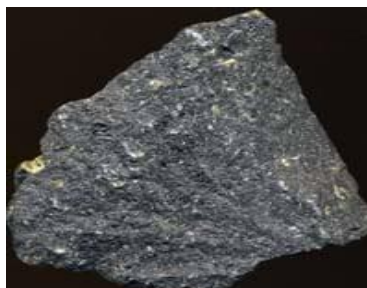
A good example of an igneous rock is granite. Sedimentary rocks are created by other rocks or fossils that form deposits on the earth's surface. Limestone is a form of sedimentary rock.

### **Types of marbles**

1. Metamorphic rock.
2. Carrara marble.
3. Onyx marble.
4. Calcite marble.
5. Parian marble.
6. Pentelicmarble.

### **Basalt**

Basalt is an rock (fine-grained) rock with usually 45–53% silicon oxide (SiO<sub>2</sub>) and fewer than 100% feldspathoid by volume, and wherever a minimum of sixty fifth of the rock is spar within the type of feldspar.



**Figure 2: Basalt**

Basalt is sometimes gray to black in color, however speedily weathers to brown or rust-red because of chemical reaction of its mafic (iron-rich) minerals into haematite and alternative iron oxides and hydroxides. though typically characterised as "dark", volcanic rock rocks exhibit a large vary of shading because of regional geochemical processes. because of weathering or high concentrations of oligoclase, some volcanic rock will be quite light , superficially resembling igneous rock to primitive eyes. volcanic rock encompasses a fine-grained mineral texture because of the liquefied rock cooling too quickly for giant mineral crystals to grow; it's usually igneous rock, containing larger crystals (phenocrysts) fashioned before the extrusion that brought the rock to the surface, embedded in an exceedingly finer-grained matrix. These phenocrysts typically area unit of mineral or a calcium-rich oligoclase, that have the best softening temperatures of the standard minerals which will crystallize from the melt.

### **Laterite**

Soil layer that's wealthy in iron compound and derived from a large sort of rocks weathering underneath powerfully oxidizing and natural process conditions. It forms in tropical and semitropic regions wherever the climate is wet. Lateritic soils might contain clay minerals; however they have a tendency to be silica-poor, for silicon dioxide is leached out by waters passing through the soil.

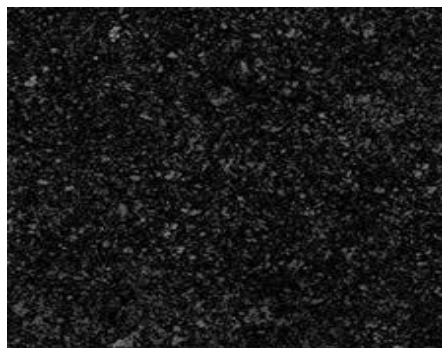


**Figure 3: Laterite**

Typical dirt is porous and claylike. It contains the iron chemical compound minerals gothite,  $\text{HFeO}_2$ ; iron ore,  $\text{FeO}(\text{OH})$ ; and iron ore,  $\text{Fe}_2\text{O}_3$ . It additionally contains atomic number 22 oxides and hydrous oxides of atomic number 13, the foremost common and overabundant of that is mineral,  $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ . The aluminum-rich representative of dirt is mineral.

### **Granite**

Granite could be a palish rock with grains massive enough to be visible with the unaided eye. It forms from the slow crystallization of rock below layer. Granite consists primarily of quartz and felspar with minor amounts of isinglass, amphiboles, and alternative minerals. It consists of quartz, feldspar, mica, and amphibole in conjunction with alternative trace minerals which offer an almost endless sort of colours and patterns.



**Figure 4: Granite**

Granite is that the rock most frequently quarried as a "dimension stone" (a natural rock material that has been take blocks or slabs of specific length, width, and thickness). Granite is tough enough to resist abrasion, sturdy enough in grips important weight, inert enough to resist weathering, and it accepts an excellent polish. These characteristics create it a awfully fascinating and helpful dimension stone. the massive mineral crystals in granite square measure proof that it cooled slowly from melted rock material.

That slow cooling had to possess occurred to a lower place layer and needed a protracted amount of your time to occur. If they're nowadays exposed at the surface, the sole approach that might happen is that if the granite rocks were elated and also the superjacent substance rocks were scoured. In areas wherever layer is roofed with substance rocks, granites, metamorphosed granites, or closely connected rocks square measure sometimes gift to a lower place the substance cowl. These deep granites square measure called "basement rocks."

**Types of Granite colors**

Kinds of granite colors confirm minerals and rocks that create granite. Quartz, amphiboles, feldspar, potassium, and translucent substance (muscovite or biotite) minerals provide granite such distinctive colors and patterns. differing types of granite colors depend upon the concentration of those minerals within the stone. as an example, quartz offers granite chiefly milklike white color, felspar provides associate degree off-white shade, mica offers dark brown or black color, mineral dark inexperienced or black, muscovite yellow or auriferous gold, and distinctive pink color comes from the abundance of metal felspar mineral. The mixtures of those minerals provide U.S.A. differing types of granite colors white granite, black granite, black and white, pink granite, red granite, blue granite, and inexperienced granite.

**Comparisons between laterite, marbles, basalts and granite**

<b>Contents</b>	<b>Laterite</b>	<b>Basalt</b>	<b>Marbles</b>	<b>Granite</b>
History	India	Egypt	Egypt	Egypt
Class	Sedimentary rocks	Igneous rock	Metamorphic rock	Igneous rock
Texture	Early, massive, porphyritic	Glassy, massive porphyritic, vesicular	Granular	Granular, Phaneritic
Colour	Brown, buff, red	Black, light to dark grey	Black, blue, pink, grey, white	Black, Grey, Orange, Pink, White
Maintenance	Less	More	More	More
Appearance	Rough and banded	Dull and soft	Veined and shiny	Veined or Pebbled
Interior architecture	Decorative aggregate flooring	Floor tiles, home tile, Hotel tile	Entryways, Floor Tiles, Homes, Hotels, Interior Decoration, Kitchens, Stair Treads	Countertops, Decorative Aggregates, Entryways, Floor Tiles, Flooring, Homes, Hotels, Interior
Exterior architecture	As building stone as facing stone garden decoration	As building stone, garden decoration	As Building Stone, As Facing Stone, Garden Decoration, Office Buildings, Paving Stone	Bridges, Paving Stone, Garden Decoration, Near Swimming Pools, Office Buildings, Resorts
Uses	Artifacts, monuments, sculpture	Artifacts monuments	Artifacts, Jewellery, Monuments, Sculpture, Small Figurines	Monuments, Sculpture, Small Figurines
Fossils	Present	Absent	Absent	Absent
Types of weathering	Biological and chemical weathering	Biological weathering	Biological, chemical mechanical weathering	Biological Weathering
Porosity	Highly porous	Less porous	Softer and more porous	Hard and solid
Specific gravity	2.75-3.0	2.8-3	2.86-2.87	2.6-2.7
Density	1019kg/m <sup>3</sup>	2.9-3.1 g/cm <sup>2</sup>	2.4-2.7 g/cm <sup>2</sup>	2.65-2.75 g/cm <sup>2</sup>
Specific heat capacity	0.75kJ/kgk	0.84 kJ/kgk	0.88 kJ/kgk	0.79 kJ/kgk
Resistance	Heat resistance, pressure resistance	Heat resistance, pressure resistance, Wear resistance	Heat resistance	Resistance to heat

Table 1: Comparisons of laterite, marbles, basalt and granite

## Results

SR.NO	SAMPLE OF TILES AND ROCK	AT ROOM TEMPERATURE (28.5° C )	AT 50° C (CONSTANT) AFTER 25 min		
			60V	80V	100V
1	WHITE MARBLE	29.6	60.8	76.8	78.3
2	PINK MARBLE	29.5	57.7	74.25	78.2
3	GREEN MARBLE	28.9	56.25	72.15	77.05
4	BLACK MARBLE	29.4	58.55	71.15	84
5	BLACK GRANITE	30.1	65.5	72	71
6	RED GRANITE	29.9	54	77.75	85
7	GREY GRANITE	29.07	76.55	77.95	81
8	PINK GRANITE	28.9	73.5	69.7	75
9	LATERITE	24.8	57.4	70.7	74
10	BASALT	29.44	59.4	89	90

Temperature 30.5°c			
At Vireshwar Temple (Outside The Temple)			
Sr.no	Type Of Tiles And Blocks	Temperature Recorded	Mean Temperature
1	White Marble	28.5, 28.3, 28.5, 28.1, 28.4	28.4
2	Black marble	30.1	30.1
3	Red granite	28.6, 29.1, 28.7, 28.8	28.8
4	Basalt With applied oil paint (yellow)	28.0 28.3 28.2	28.16
5	Basalt With applied oil paint ( blue )	29.6, 30.7, 27, 27.1	28.6
6	Basalt	28.0	28

At Room Temperature 29° c			
At Vireshwar Temple (Inside The Temple)			
Sr.no	Types Of Tiles And Blocks	Temperature Recorded	Mean Temperature
1	White marble	29.5, 29.5, 29.3, 29.5	29.45
2	Black marble	30, 29.4, 29.6,	29.67
3	Basalt With applied oil painted	29.3, 29.2, 29.5, 29.3, 29.5, 29.6	29.4

## Conclusion

The selection of suitable building materials is an integral part of architectural design as the key point of design is to meet the user health and comfort needs and to coordinate it with the materials inherent characteristics. Assessing the characteristics and environmental impacts of building materials is the core of sustainable architecture, and designers are paying more attention to material selection in this case marbles are more heat resist as compare to other materials. There will be more opportunities if materials could be taken into account early in the construction stage, i.e. at the development stage of the various codes and work plans.

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