

Building Blocks Properties and Temperature Transfer between Block Walls

Eng. Tareq Ibrahim Alkhailan.

Mechanical Engineer in the Public Authority for Applied Education & Training, Specialized trainer member in the Institute of Civil Structural Training, Kuwait

Assisted by Eng. Ali Yahya Alfadhli.

MBA Certified Civil Engineer Projects Manager at Badael Modern Materials Company, Kuwait

Email: Ali.Yahya.Alfadhli@hotmail.com

Abstract

The construction field in the Arabic gulf area is supported on the blocks materials as a primary cladding source for exterior elevations and interior walls. There are two types of blocks that are mainly used in the region. First, the solid cement black blocks which is constructed of cement, fine aggregate, fine aggregate and Portland cement. Second is the white block which Consists of Portland cement, cement ash, fine sand, aluminium powder, lime and silica. Cement black blocks act as load bearing walls, because of its high pressure and shear resistance. Add to that, the cement blocks are considered a cheap material. However, the cement black blocks considered a heavy material and overload to its holding structure. In addition, the cement black blocks are weak temperature and sound isolators, to fill the cement black blocks missing properties, the white blocks are used. The white blocks are light weigh, good temperature and sound insulators and easy to cut and build. On the other hand, the white blocks weak points are its low bearing load resistance, in which it is not possible to clad the white blocks with marble or stones. In this research paper, the gypsy blocks are introduced and studied as alternative material that have both the black and white blocks benefit and compensate for both materials' weak points.

Keywords: Building Blocks, Properties, Temperature Transfer, Block Walls

1. Introduction

The gypsy blocks are manufactured by mixing dry gypsum with glass fibres and water in a hollow block oven. The gypsy blocks are used in residential and commercial buildings and malls. In addition, it can be used in hospitals and factories due to the gypsy blocks anti-bacterial surface. The gypsum board is light weighted, in which make it a economical aid in designed the buildings concrete structure and is more safe to build as extension to existing aged structure. Moreover, the gypsy blocks have a high water and moisture resistance characteristics which make it a great choice for wet area walls such as toilets and swimming pools. Additionally, due to the gypsy blocks special chemical combination and hollow interior, the blocks services as temperature isolator which add to its economic value in energy saving because this will reduce the premises air conditional units load to maintain the desired temperature. For the same hollow interior body structure characteristics, the gypsy blocks are great sound isolators. Moreover, the gypsy blocks have a smooth surface that provide the privilege of applying the painting process directly after the blocks fixing stage without the need of doing the plastering works, which in return add a big economic value in saving the cost, time and materials of the plastering process the gypsy blocks are fixed through been placed in aligned rows and are supported by gypsum powder adherence that are mixed with water and applied between each horizontal and vertical blocks. Windows and doors opening can be made in the gypsy blocks walls by adding a galvanized 3mm sheet above the wall opening.

1.1. The study problem

The following study discuss the disadvantages in using the traditional black and white blocks that are used as the prime buildings cladding in the Arabic gulf areas since the past century, such disadvantages start from the blocks heavy weight that tools additional cost on the building through requiring additional reinforcement in the concrete structure. Furthermore, the black cement blocks do not serve as good sound and temperature isolators which in respond requires additional costs for adding insolation materials and additional energy loads through air condition units to maintain the premises temperature, such downsides can be solved through replacing the black cement block with the white lime blocks which is characterized by being light weighted materials and good sound and temperature isolators. However, the white blocks problems are that it is not a good choice to be fixed in wet areas such as toilets and swimming pools and like the black cement blocks, the blocks need to be applied with the plastering process before proceeding with the

painting and finishing stage. For both the black cement and white lime stones displayed problems, the gypsy blocks act as the solution for both materials disadvantages in addition to other benefits.

1.2. The Study Aims:

The study main goal is to Point out the flows of the classic black cement blocks and white lame blocks. In addition, to display the how the gypsy blocks solve the classic blocks downsides. Furthermore, identify the advantages and usage of the gypsy blocks.

1.3. The Study Methodology

The study methodology depends on the scientific study of the gypsy blocks chemical compound and physical characteristics that made the gypsy block a construction material choice for varies applications in a tested field of study and usage.

2. The Study Framework

The study farmwork will demonstrate the function and aids of using the gypsy blocks as an alternative material to the black cement and white lime blocks supported by lab tests and practical filed experiments

The study farmwork can be summarized in the following bullet points:

- 1- The definition and description of the physical characteristic of the gypsy blocks.
- 2- The gypsy block plastering free ready to paint surface.
- 3- The gypsy block weigh
- 4- The gypsy blocks Thermal insulation properties
- 5- The gypsy block water and moister isolation properties
- 6- The gypsy block sound insolation properties.
- 7- The gypsy blocks fire resistance properties.

2.1. The definition and description of the physical characteristic of the gypsy blocks.

The gypsy block is the commercial name of the gypsum buildings block, are lightweight building blocks made from gypsum, a naturally occurring mineral found in sedimentary rock formations. Which are composed mainly of gypsum, along with water, plaster, and sometimes additives like fibres for enhanced strength. The gypsy blocks are hollow rectangle blocks that are produced in sizes of 50x50x15cm and 50x65x10 cm as the common sizes used in the Arabic gulf area.

2.2. The gypsy block plastering free ready to paint surface.

The gypsy blocks have a smooth surface that's ready to paint or wallpaper, eliminating the need for additional plastering or finishing unlike the black and white traditional blocks. In which, add a huge time and cost saving benefits by shortcutting the time required to apply the plastering works and eliminate the plastering materials and the preforming manpower costs.

2.3. The gypsy block weigh.

Compared to cement or lime blocks, gypsy blocks are significantly lighter, making them easier to handle and install, reducing (load) on the building's foundation in which saves building reinforcement costs and are easier to build, which means the building manpower can build more in single day, which in return saves time and cost.

The following table demonstrate the surface mass of the gypsy blocks in compare with cement and lime blocks for 10cm thickness.

Table (1): the difference in surface mass comparison between gypsy blocks, cement block and lime blocks

Block type	Single block size (cm)	Surface mass (Kg/m ²)	Breaking load (KN)
Cement block (1, 2023)	40x20x10	178	9
White lime block (5, 2016)	60x20x10	51	4
Gypsy block (2, 2020)	65x50x10	70	5.7

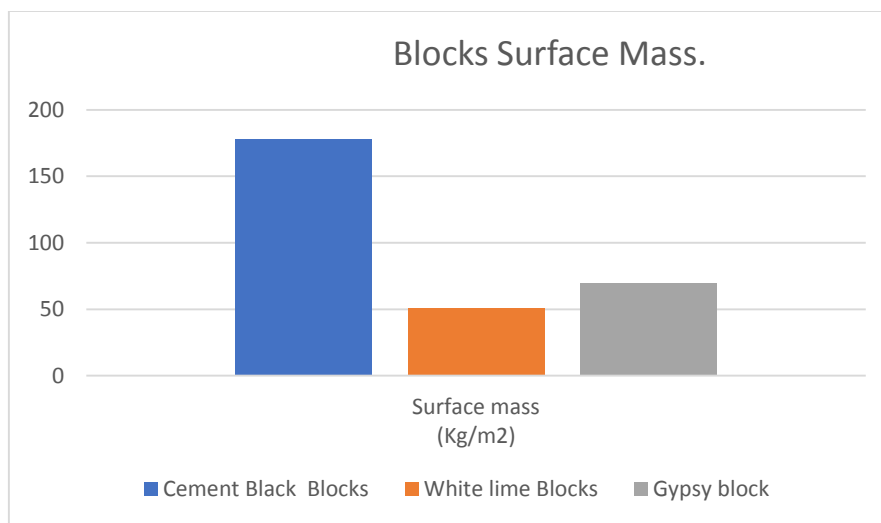


Chart 1: Blocks Surface Mass compression chart

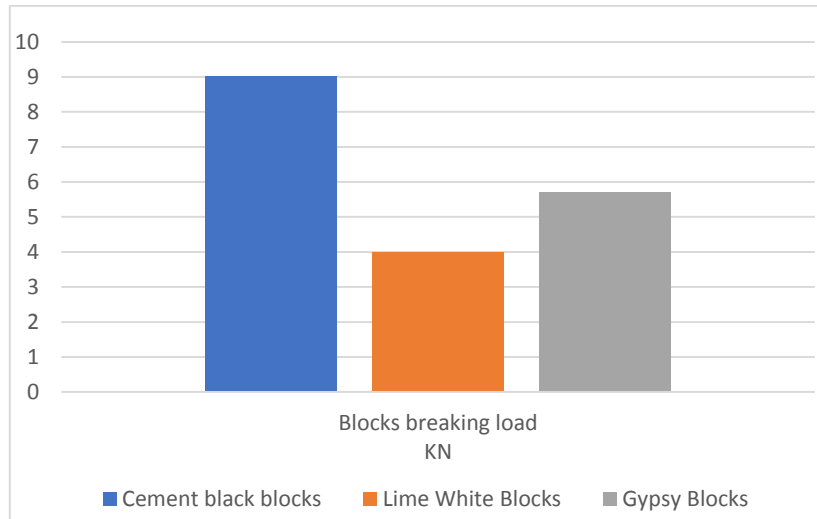


Chart 2: Blocks Breaking Load compression chart.

2.4. The gypsy blocks Thermal insulation properties

Gypsy blocks gypsum component offers thermal insulation, which can improve energy efficiency in buildings which in return reduce electrical loads which saves some energy costs.

The following table shows the cement, white lime and gypsy blocks thermal conductivity measurements for 10cm thick block sample per each.

Table (2): the thermal conductivity comparison between gypsy, cement and white lime blocks

Block type	Thermal conductivity W/mk
Cement block (1, 2023)	0.7
White lime block (5, 2016)	0.6
Gypsy block (3, 2016)	0.3

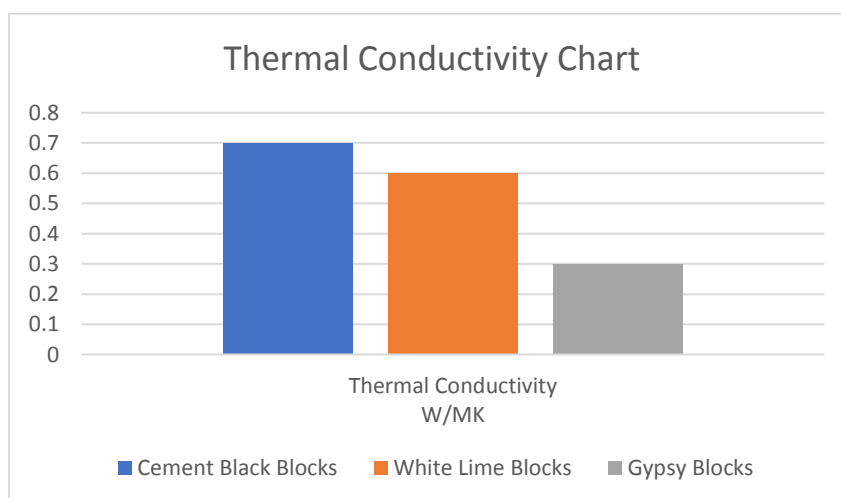


Chart 3: Thermal Conductivity Compression Chart.

5.5. The gypsy block water and moisture isolation properties

Gypsy blocks, while commonly used in construction, do have the best qualities when it comes to water and moisture resistance, which can be used in wet areas such as pools, toilets.

The following table shows the cement, white lime and gypsy blocks water absorption measurements after 2 hours samples fully immersed test for 10cm thick block sample per each.

Table (3): 2 hours immersing test water absorption comparison between Gypsy, Cement and White lime blocks.

Block type	blocks water absorption %
Cement block (1, 2023)	9.5
White lime block (1, 2023)	6
Gypsy block (4, 2017)	0.4

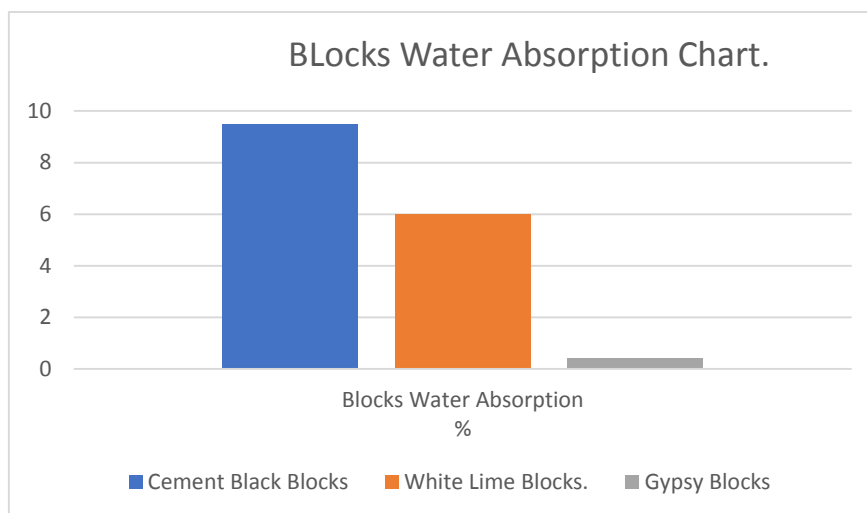


Chart 4: Water Absorption Compression Chart.

2.6. The gypsy block sound insulation properties.

Gypsy blocks offer decent sound insulation properties for non-load bearing interior walls, making them a suitable choice for many everyday construction applications, due to their mass and density, effectively dampen sound waves, offering better soundproofing than traditional drywall.

The following table shows the cement, white lime and gypsy blocks soundproofing acoustic insulation test for 10cm thick block sample per each.

Table (4): sound acoustic insulation comparison between Gypsy, Cement and White Lime blocks.

Block type	acoustic insulation dB
Cement block (1, 2023)	30
White lime block (1, 2023) (5, 2016)	40
Gypsy block (3, 2016)	40

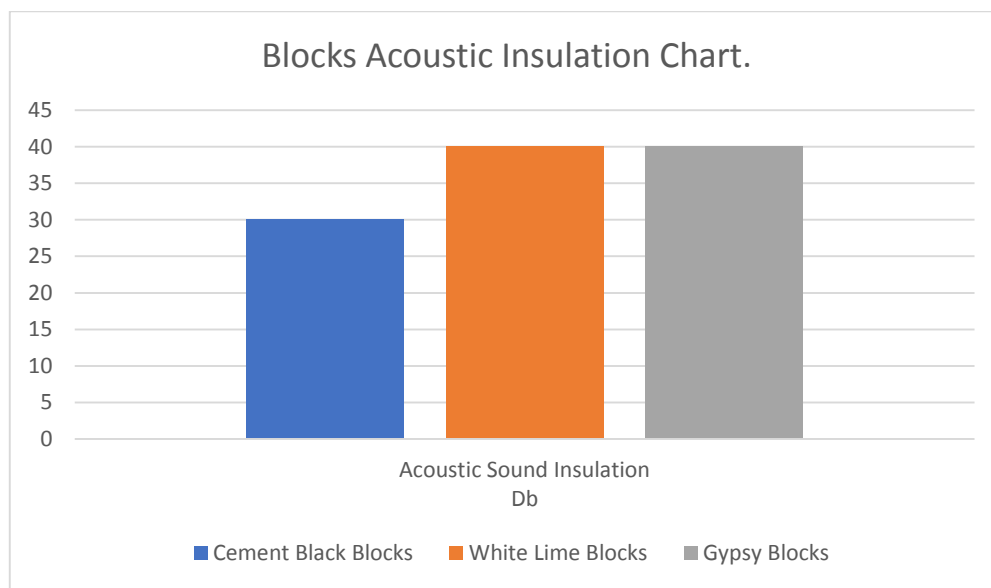


Chart 5: Blocks Acoustic Insulation Compression Chart.

2.7. The gypsy blocks fire resistance properties.

Gypsy blocks boast impressive fire resistance properties, making them a valuable choice for building safety and kitchen areas due to gypsy blocks hydrated Crystal Structure.

The following table shows the cement, white lime and gypsy blocks fire resistance rate test for 10cm thick block sample per each.

Table (5): fire resistance rating comparison between Gypsy, Cement and White Lime blocks.

Block type	Fire Resistance Rating (min)
Cement block (1, 2023)	90
White lime block (6, 2017)	60
Gypsy block (3, 2016)	180

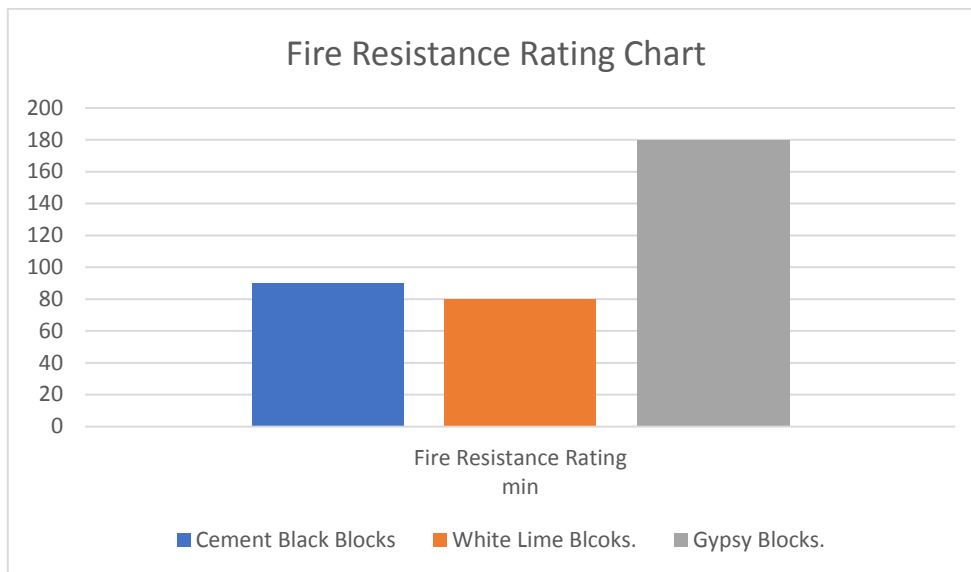


Chart 6: Fire Resistance Rating Compression Chart.

3. The Study Results and Discussing

The above results shows that the gypsy blocks are the only blocks with smooth surface that requires no plastering works before applying the finishing layer. In addition, the data in table (1-3) indicate that the gypsy blocks are lighter than the cement black block by 60% but the black blocks have a higher load bearing capacity by 40%. The white blocks are lighter than the gypsy blocks by 29%, but the gypsy blocks have a higher load bearing capacity by 30% more. Moreover, as shown in table (1-4) the gypsy blocks temperature insulation ability are twice the ability of the black cement and white lime blocks. Additionally, as indicated in table (1-5) the gypsy blocks are better water resistance material than the cement black and white lime block, as shown in the sample fully immersed test the gypsy blocks water absorption is almost zero in compare with black blocks 9.5% and white blocks 6%. Furthermore, the gypsy blocks can isolate sounds better that their peers as been displayed in table (1-6) acoustic test that resulted the gypsy block sample with 40 dB units in compare with the black and white blocks that resulted in 30dB30dB. Last but not least, the gypsy blocks can resist fire more than the white and black blocks as demonstrated in table (1-7) 500C oven test results that shows the gypsy block ability to withstand fire for 180 minutes which is twice the time of the black and white blocks that resulted 90 minutes each.

The study results for the blocks superior quality comparison points can be summarized in the following table and chart:

Table (6): Summary table.

Blocks type	Cement Black Blocks.	Lime White Blocks.	Gypsy Blocks.
Quality Point			
Lighter Surfess Mass		1	
Greatest bearing load capacity	1		
Best thermal insulator			1
Best water isolator And moisture resistance			1
Best sound insulator			1
Best fire resistance			1
Overall quality points	1	1	4

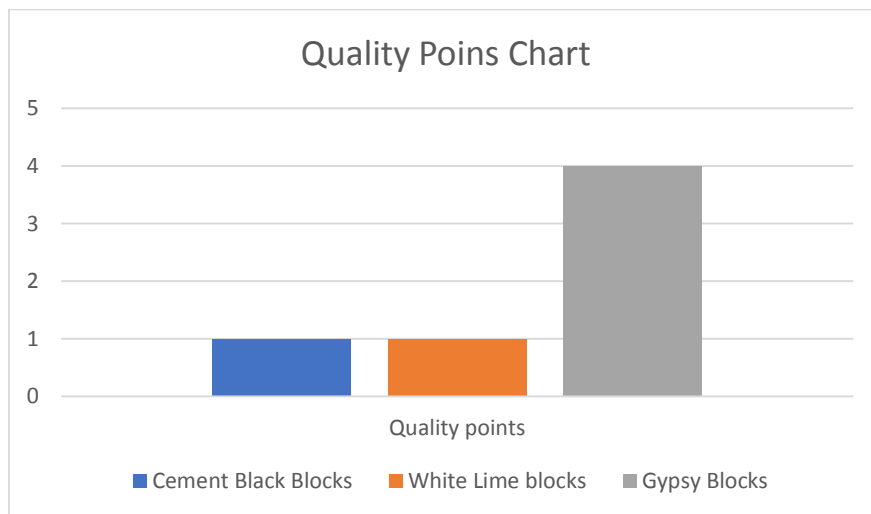


Chart 7: Summary Chart overall quality points Compression Chart.

4. The Study Conclusion

The gypsy blocks are the better modern era material construction chose for the interior non-bearing walls for the blocks properties and economical values that supress the cement black and white lime blocks starting with the gypsy blocks smooth surface that delete the need of the plastering stage, Furthermore, being a light wight materials that tools less load on the buildings structure and less pressure on the building man power that results in more work activity per day and less building reinforcement work and cost especially when building extensions in aged buildings.

Moreover, the gypsy blocks are better material choice for wet areas due to its superior water and moisture resistance properties. Additionally, gypsy blocks offer effective sound isolation as they can reduce the sound intensity passing through the wall by 40dB, make it better chose for comfort in quite places like residential buildings and hospitals. Add to that, the gypsy blocks have a fire resistance ability to stand active fire up to 180 minutes, which make the gypsy block safe materials for construction locations and kitchen areas.

5. The Study Recommendations

It is not recommended to build the gypsy blocks as exterior façade without applying the external isolation layer or when fixing a heavy load bearing materials such as marble or steel frame façade. Furthermore, the gypsy blocks should be supported by the block's special gypsum adhesive powder, after mixing with water. Add to that, the gypsy blocks should be supported by the block's special gypsum adhesive powder, after mixing with water. More than that, the gypsy blocks should be supported by the block's special gypsum adhesive powder, after mixing with water. Also, the gypsy blocks should be cut using the mechanical saw only to avoid damaging the blocks interior component. Last but not least, it is recommended to use screws instead of nails to avoid damaging the blocks surface.

6. References

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