

Comparison Study Of Using Natural Local Stone And Artificial Stone In Buildings In Order To Achieve Sustainability

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ABSTRACT: The purpose of this research is to encourage Saudi people Using stone extracted from quarries in the region, the same as it was used to complete the building processes as it was in the past extracted from mountains of Taif city, in order of achieving both the sustainability of such building and to improving the economic side when comparison with new building material, in addition to improve the situation of stone quarries locations when expansion out of the border city, some of these stone quarries produce different valuable products such as marbles, other stone quarries produce aggregates and construction materials use in infrastructures of building and roads, the main aim of this research is focusing on style of building that used the local stone in past, comparing with such style of new building in order of keeping this heritage for new generations and to show such valuable style for other people who comes to visit Taif city as tourist. Taif city consider one of the most important city in kingdom of Saudi Arabia as the best summer residence in Saudi Arabia, and Arabian gulf, so it the responsibility of the municipality, and heritage authority to take the initiative by planning some special places have characterized style of a traditional buildings built by using local stone with same methods of construction design to fit the achievement of people. And to appear the abilities of old technology used by grandparents

KEYWORDS - *Old Buildings Styles, Sustainability, Stone Buildings, Stone Quarries.*

I. INTRODUCTION

The main aim of this research is focusing on style of building that used the local stone in past, comparing with such style of new building in order of keeping this heritage for new generations and to show such valuable style for other people who comes to visit Taif city as tourist, Taif city is very rich of such mountains that have same stone were used in buildings in past by our grandparents, many visitors with their families from different places in Saudi Arabia, and Arabian Gulf usually comes in the summer to enjoy their vacation summer time to enjoy the beauty of nature, and watch such old style of buildings and palaces that are still proud of it until now. On the other hand this research spotting light on improving the economic situation of Taif city by offering a lot of different kind of jobs for graduates. It also maintains the capital as a result of determining import operations for this type of building materials and work on the introduction of financial return through export operations for the same kind of material.

II. RESEARCH METHODS

In this research I used the comparison methods of building stone which was used in past and the new methods that use different kind of artificial stone as cladding materials use in building constructions, Taif city has a lot of mountains consider as stone quarries, to be as the sources of the normal stone, were it distributed in different locations of the city. Some of these sites owned by the state, and others were owned by some local people, in both cases special test should be done to examine that area by the official authorities to make sure about type and quality of the rock if it conforms to specifications, or if it has other materials and minerals. Meanwhile it needs to a license in order to start production processes of cutting stone. Building of stone can be built in different ways, and the common ways are traditional one, and mechanical, both of them need special conditions with specifications and characteristics during building processes. These raw materials of rocks that cut from stone quarries need some processes to be formed upon to the design request of buildings, special machines, and professional workers needs in both cases, when shaping stone or when start building processes. To achieve the purpose of this research I designed special questionnaires in order to get the point views of some engineers and workers who deal with this sector, the results of this questionnaires will show later when completing the research.

III. RESEARCH OBJECTIVS

At the moment, the stones which use in construction it has no any structural function, but are used to impart Aesthetic character for building, and to protect it from weather conditions (a substitute for plastering) making stones which use today in construction these days less thickly than the stones of old buildings, which were consider as. (Bearing walls) with a function known as structural load-bearing walls, the most common method of building which is use now at the general of Saudi Arabia is the artificial material whatever stones or other materials in cladding walls, pats and turning walls, and even the historical and heritage building, of course such material may have some specifications, like atheistic, quick in building process and so on. Down town, and other historical locations usually should build by using same traditional design and building materials, which is very plenty in Saudi Arabia, in fact this is the main point in the research that I spot the light here to achieve the purpose of the research, each buildings it may has limit time after that it may demolish or make new justification or new design or new look, so such artificial materials will be loss as rubbish, and we should remember the cost of such raw materials, that need also more cost when you start building process or even maintenance later, in addition to other cost added for other utilities such as conditioning, and demolished, and transfer the rubbish material after demolished, in the other hand, using natural stone will increase the economic income of the country and will create more vacancies for graduates, and this kind of material doesn't need more cost when designing of conditioning, and it may use for long life, and keep country clean because of using such materials in buildings.

IV. STONE DEFINITION

Rocks define as concretion of earthy or mineral matter, the rocks which consist of stone are divided into three types, the most important are igneous rocks, sedimentary rocks and metamorphic rocks, so the most common definition of stone is that was not out of his natural constituent material, such a concretion of indeterminate size or shape. Stone is founded in different locations with different specifications and quality. Stone masonry which is usually extracted from the rock found in the mountains which consider the main resources, divided in around locations in Saudi Arabia, the stone specifications may vary by region, but it is necessary to take into account some important conditions and specifications that must be available in the stone masonry, such as the following important specifications.

- 1- Strength & Durability:** The more compact grained and heavier the stone is more hardness.
- 2- Sunlight:** When some stones are used in exterior applications and exposed to direct sunlight they fade or change color.
- 3- Moisture:** Some stones have moisture sensitive mineral contents that will cause the stone to develop rust spots, or other color variations, or contain moisture sensitive substances that will cause blotchy and streaking discolorations
- 4- Porosity & Permeability:** Porosity is the ratio of pores (micro-voids) in the stone, to its total solid volume.
- 5- Hardness & weathering:** Hardness is the property of a material to avoid and resist scratching.
- 6- Water absorption and frost resistance:** Moisture from rain, snow or other environmental conditions penetrates the wall leading to cracks, efflorescence, rust staining, and wood rotting, paint peeling, darkening of masonry. The perfect sealing of a masonry wall surface is almost impossible since fine cracks and joints will allow the passage of water into the wall.
- 7- Absorbency:** It is the result of these two properties (permeability and porosity). Absorbency is an important determining factor in stones sensitivity to stains. The size of the pores, their orientation, how well they are networked and the type of finish the stone has are important contributing factors to a stones overall absorbency. These kind of stone it may have different shape, size and different uses, and passed the tests that mentioned above as shown in fig. 1

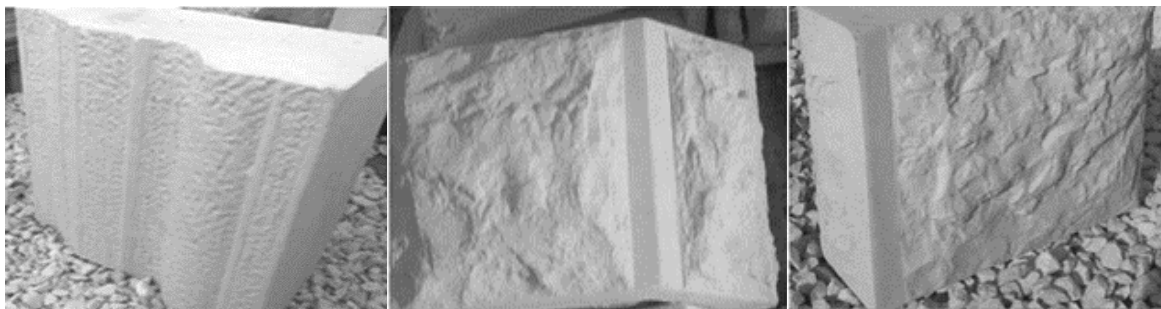


Fig. 1 different shape, and size

V. METHODS OF STONE BUILDING

Despite the end of his role as a building material, natural stone in all kinds of Stone, Marble and Granite it's still considered the most material choice among architects, because of its natural beauty and lack of need for maintenance, stone material has become produced for purpose of the cladding walls in the form of slabs has a small thicknesses. Previously stone used as stone load-bearing instead of columns. In case of building stone, it's usually use the common two ways the traditional one or the mechanical way, and both of each way has its own advantage's and disadvantage, and both ways were used for aesthetic, and strengths to have long life. As well as increases the use of buildings for a long term in addition to its ability to withstand the vagaries of the weather and the weather, this contributes to the whole subject of sustainability. The mechanical way has another name, which it's called as Dry Fixing System, because in this case there is no any concrete between building stone and walls, which is consider as an advantage point in conditioning system, as shown in fig. 2



Fig. 2 The gab behind stone and wall

The construction process in the traditional methods are considered less expensive, and slower than the mechanical way, it may be used in the construction process in general, but they need skilled workers to maintain the quality of construction to avoid problems do not occur in the future and cause the separation of the stone from the concrete, causing his downfall, because of the different stone and concrete density, Fig. 3 show the method of traditional buildings in past and the modern way of construction. The traditional construction process is considered slower than the mechanical method because of the inability to continue for more than three stone courses over each other.



While in the mechanical method, it features fast installation and easy maintenance work later, control the architectural design and aesthetic side, and thermal insulation of building. Special joints and connecting material use in the purpose of using mechanical method's, and in all applications all of these tools and materials, which is supposed to be made of iron non-stainless steel with different kinds as shown if fig. 4



Fig. 4 the connecting tools non-stainless

Fig. 5 show some different methods of using for the different kinds of connecting tools in building constructions



Fig. 5 show some different connecting tools

Mechanical methods has some special and perfect specifications, such as the points mentioned down. fig 6 show mechanical way, with decoration stone.



Fig. 6 show mechanical ways, with decoration stones.

- It considered calculated accurately to withstand loads such as vertical weights as well as horizontal loads such as wind and earthquakes.
- Greater speed, especially in the high and large buildings implementation.
- Ease of maintenance operation, changing any piece of stone will be easier than other methods.
- Greater freedom in the design, where the designer can achieve architectural pattern they desire easily.

Mechanical stone building method are divided to three ways, and the most important way are.

- 1- Load bearing angles restrains with the horizontal supports.
- 2- Combined support and restrain system.
- 3- Channel system. Which it is considered the speediest way in the construction process, without relying on the rear wall.

In all cases referred to the mentioned above, we have to use a special metal, stainless steel to be used for a longer period of time.

After analyzing the results of the questionnaire, I got the following result as shown in the following diagram, it seems that most engineers, prefer using stone extracted from local stone quarries, in all of its forms and types. And they appreciated such projects, since it will offer a lot of vacancies for graduates, and they will be care about to conserve of the typical heritage and historical of our grandparents, and will improve the economic situation because of buying the local production of stone extracted from local stone quarries, of course all extracted stones need to reshape based on to the architectural design and it may need for treatment to fulfill the requirements of design. Even the rest of the remnants of quarries can be used as building material after preparing according to the type of use, such as gravel and soft, and other materials of course, such data give a positive sign on the subject of sustainable development. Which confirms the requirements of outcomes of search. The result of analyzing the questionnaire shown in fig. 7.

- 1-52% of contractors, engineers, and citizen owners prefer the modern methods the mechanical way which consider more expensive than the traditional method, because of its characterized.

- 2- Where 33% of the sample test prefer to use natural stone extracted from local quarries, using traditional methods of building, after forming it upon to the requirements of the architectural designing.
- 3- 15% of local citizens owners prefer the common method of using block with plastering, because this way is cheapest comparing with the other ways which using stone in building. As shown in fig. 7

VI. CONCLUSION

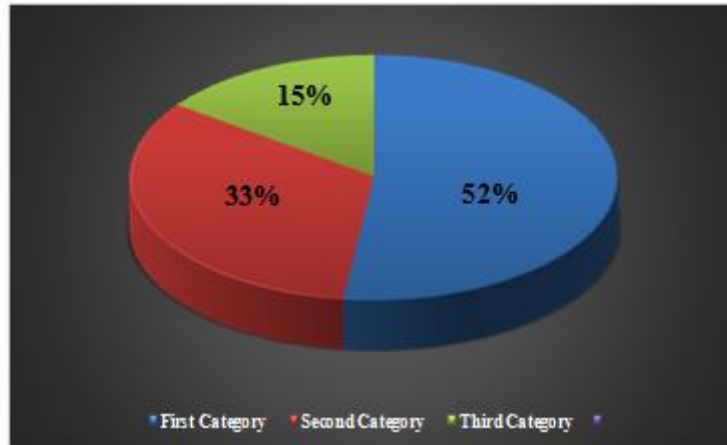


Fig. 7 The result of analyzing the

The conclusion of this research are upon to my humbly analyzing measured the.

- 1- The majority of target group prefer using the modern way (mechanical methods), even it's more expensive.
- 2- The modern way means that the stone extracted from local quarries need more of shaping and treatments processes.
- 3- This case means to need more graduates that will offer a lot of vacancies.
- 4- Using the local stones after will need more specialist workers and skilled workers.
- 5- Will help the state in improving the economic situation, when local citizen will work and manage the sites.
- 6- Get rid of the remnants of stone quarries used as building materials, which revives the economic situation as well as to maintain the cleanliness of the country.
- 7- The possibility of extracting other relevant valuable materials of these quarries, like some precious metals.
- 8- The remnants of quarries can be used as building material after preparing according to the type of use.

All of these conclusions mentioned above confirms the requirements of search so. Through these results, we note that these results confirm the output targets of research in order of achieving the principles of sustainable development, to preserve the rights of new generations in all natural resources of the country.

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