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A Technical Study on Quarrying and Processing of Marble and Its Waste Incorporating With Concrete

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ABSTRACT

Marble waste is generally a high polluting waste due to both its high alkaline nature, and its manufacturing processing techniques, which impose a health threat to the surrounding. The quarries and processing plants are littered with large amounts of waste products deriving from extraction, sawing, polishing. At present, no significant activities are in place to recover and reuse the ultrafine CaCO3 dust combined in waste slurries of marble processing plants. It can be helpful to considering these calcareous particles as primary or secondary raw materials for use in other production. The main objective of this paper is to study the production process of the marble and during the production process how much waste is generated during the production process.

KEYWORDS: crumb rubber, utilization, compressive strength, low cost, sustainable

INTRODUCTION

The word marble comes from Greek word mamaros which means shining stone. Marble is a non-foliated, granular metamorphic rock that is formed by metamorphism of limestone and dolostone. Marble is a Calcium Carbonate (CaCO3). The term marble is also applied to Serpentine rocks that can be polished to high shine. These are the natural stones which can be shaped in form of blocks, slabs, tiles, etc. and are used for monumental and decorative purposes since antiquity; various civilizations have used dimension stone in many ancient building and monuments that have survived to the present day. Marble cutting industry produces large amounts of solid wastes on large areas, which are expected to increase as construction is continuously increased, owing to the fact that the world production of marble industry has been increasing annually in the recent years.

By the factors of production we mean all inputs, such as land, labour, machinery, equipment, capital, and entrepreneurship that produce finished and final products such as marble slabs, tiles, sculptures, tables, etc.

One of the most important factors of production in marble industry is technology (i.e. machineries and equipment in use). Due to the nature of business, machinery plays a big role in the success and productivity firms. By employing standard machineries, they can increase their productivity. In quarrying activity, blasting is the old method of production, while diamond wire cutting is the new method of quarrying. With blasting, quarries not only lose 50 to 80 percent of the material, they can also cause great damage to the entire quarry by enforcing micro-fractures throughout the entire deposit. Whereas with diamond wire saw cutting, the percentage of waste can be reduced to 7 percent, while creating no damage to the marble deposit. During marble processing, 30% of the stone (in case of unprocessed stone) goes to scrap because of being in smaller size and/or irregular shape.

QUARRY PROCESS

The quarry process of marble there are several stages in this process the main stages are covered as under with figure.

[1] Exploration (Identification of a Quarry Location)

The first stage of the production is to identification of a quarry location. In this process first identification the location, when the location of marble quarrying is identified, a sample of the stone is taken to test its colour and characteristics. The quarrying process starts after obtaining necessary approval.



Fig-1 Marble exploration, a productive quarry is being identified
Source: www.alibaba.com

[2] Drilling

Drilling is the second process of the production process of the marble. There are main two type of the driller is used. (1) pneumatic steel driller (2) pneumatic down-the –hole driller. The pneumatic steel driller is used for vertical, horizontal or inclined drilling process and pneumatic down-the-hole driller requires for making vertical holes for introducing the diamond wire.



Fig 2: Pneumatic driller
Source: www.alibaba.com



Fig 3: Down the whole driller
Source: www.quarryingtools.com

[3] Primary cuts
The third step of the process is the primary cuts. In this process identified area for marble quarrying is cut into large cuts with the help of the diamond wire machine. In this process the vertical hole drilling is introduce the diamond wire machine. The figure of the diamond wire machine is as under.



Fig 4: Diamond wire machine
Source: www.quarryingtools.com

[4] Hydraulic cushions
The forth step of the process is the use of the hydraulic cushions. This process is start after primary cut by diamond wire machine. In this process when the primary cut is done then after the steel pushing bag is put in the gap of the primary cut and with the help of the pressure enlarging the space between cut benches. Figure of the hydraulic cushion with expansion cutting are as under.



Fig 5: Hydraulic cushion
Source: www.quarryingtools.com

[5] Lifting and transportation
The fifth step of the process is lifting and transporting. In this process the cut block of the marble loaded in the truck with the help of the lifting equipment like crane. The truck transports the raw marble to the factory. Transportation process is very crucial step in this process.



Fig 6: Crane
Source: www.alibaba.com



Fig 7: Truck fitted with lifting equipment
Source: www.alibaba.com

FACTORY PROCESS
[1] Gantry carne
Unload the truck with the help of the gantry crane is the first process in factory. The figure of the gantry crane is as under.



Fig 8: Gantry crane
Source: www.alibaba.com

[2] Multi wire cutting machine
This is the second process of the work, in this process the marble is cutting in slab with the help of the multi wire cutting machine. The figure of the multi wire cutting machine is as under.



Fig 9: Multi wire cutting machine
Source: www.alibaba.com

[3] Polishing
This is the last process of the marble process. The upper surface of the marble slab is polished with the help of marble polish machine.



Fig 10: Marble polishing machine
Source: www.alibaba.com

At the last we get the marble in slabs which are used in many areas in construction work like flooring, tiles etc.

MARBLE WASTE

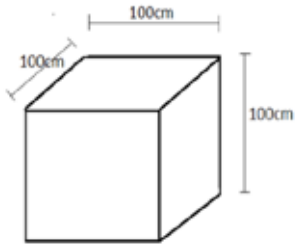

Fig 11: Marble cube
We assume that this is the 1m3 marble cube like 100cm height X 100cm width X 100cm length. If cut this cube in to 2cm thick slab, so we assume that there are 50 slabs are made in this cube but in the cutting process 1cm thickness is waste in cutting and polishing process (0.8cm in cutting process and 0.2cm in polishing process). Only 33 slabs are made. During this process 33% wastage we get. So this waste is used for making brick, block and in concrete for replacement of some materials.

CONCLUSION

- Blasting is the old process of the quarry the marble in this process waste is produced in more quantity and damage is produce in entire quarrying area.
- If we use the diamond wire percentage of the waste can be reduce 7 percent.
- In the manufacturing process of the marble slab in 2 cm thick, the waste is produce in each slab is 1 cm (0.8 cm for cutting and 0.2 cm for polishing the upper surface)
- During the cutting process 33% waste can be produced. And this waste is used for making other important material or items like bricks, blocks etc.
- Uses of marble waste in concrete can save the stone industry disposal costs and produce a 'greener' concrete for construction.
- An innovative supplementary Construction Material is formed through this study.

REFERENCES

[1] Azza I. Kandil and Tarek H. Selim "Charecteristics of the marble industry in Egypt" the American university in Cario. | [2] Abdul Ghafar Rassin "A Comprehensive study of marble industry in Afghanistan" Research and static department AISA 2012 | [3] Bradley, Frederick. The Stone Industry Worldwide: Current State and Trends, Marble-Stat 2002. | Associazione Italiana, Panorama, 2002 | [4] Fakher J. Aukour "Incorporation of Marble sludge in Industrial building eco-blocks or cement bricks formulation" Jordan journal of civil engineering vol 3 no 1 2009 | [5] G. Marras, N. Careddu, C.Internicola, G.Siotto "Recovery and reuse of marble powder by product" Global stone congress 2010 | [6] http:/en.wikipedia.org/wiki/marble | [7] MSME-Development Institute "Status report on commercial utilization of marble slurry in Rajasthan" | [8] Mubarak, Khalid. "A Lost Egyptian Treasure: The World Awaits Egyptian Marble", Al-Ahram | Newspaper, Friday June 27, 2003. | [9] National Bank of Egypt. "Market Study on the Marble Industry in Egypt", unpublished manuscript, 2002. | [10] Panos Tomaras. "Ancient Greek Marbles some still used today." In litosonline.com. May 2002. | [11] Rania hamza, Salah El-Haggar, Safwan Khedr "Utilization of marble and Granite waste in concrete bricks" International conference on Environment and Bio-Science IPCBEE vol.21 2011. Singapore | [12] Sardar Shahid Farid "Investment opportunity profile for marble processing plant in NWFP" Community Based Livelihoods Recovery Program (CBLRP) for earthquake affected areas of azad jammu and kashmir and NWFP (2007). | [13] www.alibaba.com | [14] www.quarryingtools.com |