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Investigation of Clay Brick produced using Marble and Granite Waste

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Abstract:- The purpose of this study is to incorporate waste products in the construction sector for sustainable and environmentally friendly production. The following investigation provides an alternative way of utilizing quarry waste in the construction industry. In this study clay bricks are produced using granite and marble slurry waste. Different mix proportions are prepared and bricks are cast. These brick samples are tested for compressive strength and water absorption based on IS code and an optimum percentage of replacement is obtained. The results showed that 10-15% replacement gives maximum compressive strength and minimum percentage of water absorption.

Keywords:- *Brick, Clay Brick, Granite Slurry, Marble Slurry.*

I. INTRODUCTION

Every year, the quantity of industrial waste produced rises. Waste produced during manufacturing or other industrial activities is called industrial waste. Stone has played an important role in human pursuits since recorded history began, and its use has varied over time. Nature has bestowed large deposits of marble and granite in India. The cutting industry generated a considerable volume of granite and marble slurry. The quantity of waste produced during the mining and manufacturing of granite and marble is one form of industrial waste. These wastes have a negative impact on the environment and human health. To reduce these effects these wastes can be used in the construction industry like brick making, concrete, etc.

Rapid urbanization and industrialization in Indian cities have predicted a massive increase in infrastructure demand. For a living, an increasing number of people are migrating from rural to urban areas. This has resulted in the mass construction of homes. Bricks, as one of the most important building components, which is produced using clay, energy, and water as resources. The rapid exploitation of such resources not only produces an environmental imbalance but also raises concerns about the sustainability of growth. The properties of brick such as compressive strength, water absorption, density, shape, size, colour, and efflorescence can be improved by incorporating these elements into the clay.

➢ *Scope of Study*

The following objectives have been established for the current study:

- To observe the properties of brick specimens when clay is replaced with marble slurry and granite slurry.
- To determine the optimum percentage of replacement.
- To utilize these wastes effectively and reduce the exploitation of natural resources.

II. METHODOLOGY

To achieve the objectives and to develop concepts that are fundamental for the formation of the entire research work, a comprehensive literature review is conducted, which includes a review of periodicals and academic journals, seminars, and research papers.

The major parameter tested in this study is clay brick with sand replaced by granite slurry and marble slurry increased by 0%, 5%, 10%, 15%, 20%, and 25%. These brick samples were investigated for compressive strength and water absorption. For this study, brick samples were by the following process:

- Clay Preparation.
- Moulding.
- Drying
- Burning or Firing of bricks

After the production, the brick samples were tested for compressive strength and water absorption based on the Indian Standard.

➢ *Compressive Strength:*

Compressive strength is heavily impacted by the properties of the raw material as well as the manufacturing method. It is well known that the raw clay used to make old bricks was frequently of poor quality, and the manufacturing process was basic and inefficient. The average value of compressive strength of clay brick is 12.5–27.5 MPa.

➢ *Water Absorption:*

Clay bricks have an appropriate water absorption range of 12% to 20%. If you use engineering bricks, the closer you get to 12%, the better the result. It may be difficult to obtain a proper connection between the mortar and the bricks when the water absorption is too low, i.e. less than 12%.

III. RESULTS AND DISCUSSIONS

Table 1 Compressive Strength Test Results for Granite Slurry

Sample	Replacement Percentage	Compressive Strength(N/mm²)
G1	0	12.26
G2	5	13.01
G3	10	13.69
G4	15	12.11
G5	20	11.05
G6	25	9.23

Table 2 Compressive Strength Test Results for Marble Slurry

Sample	Replacement Percentage	Compressive Strength(N/mm²)
M1	0	12.26
M2	5	12.68
M3	10	13.35
M4	15	13.89
M5	20	12.05
M6	25	10.78

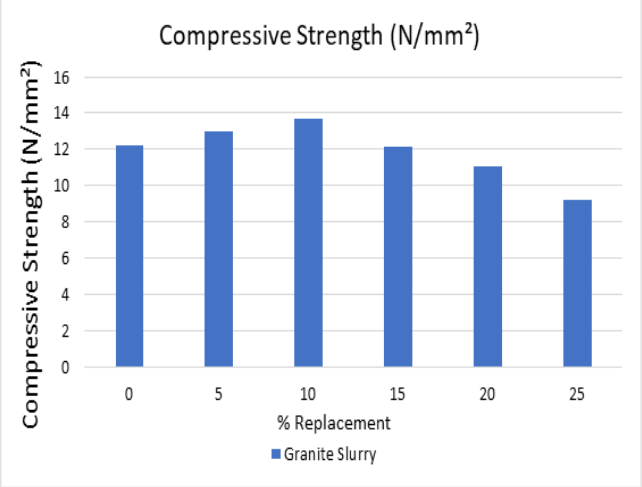

Fig 1 Variation of Compressive Strength vs % Replacement of Granite Slurry

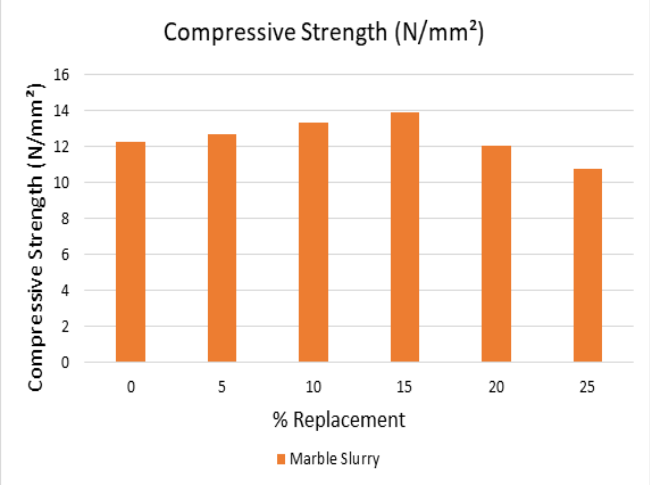

Fig 2 Variation of Compressive Strength vs % Replacement of Marble Slurry

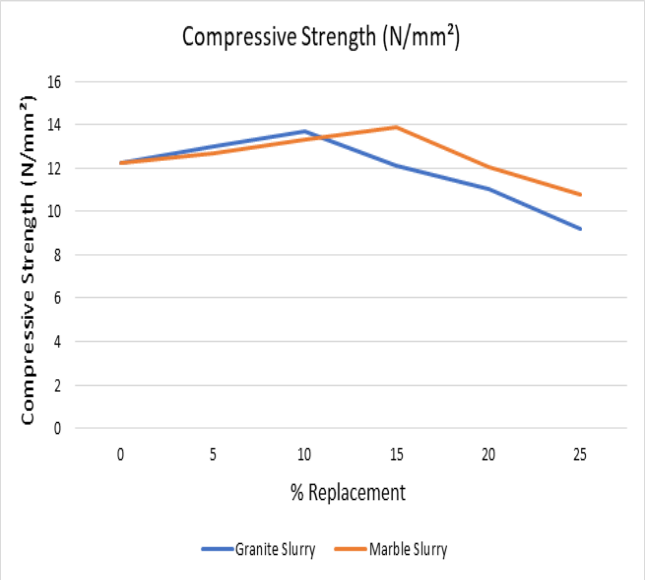

Fig 3 Comparison of Compressive Strength

Table 3 Water Absorption Test Results for Granite Slurry

Sample	Replacement Percentage	Water Absorption (%)
G1	0	13.71
G2	5	12.93
G3	10	12.54
G4	15	13.78
G5	20	15.68
G6	25	16.31

Table 4 Water Absorption Test Results for Marble Slurry

Sample	Replacement Percentage	Water Absorption (%)
M1	0	13.71
M2	5	13.22
M3	10	12.10
M4	15	13.68
M5	20	15.02
M6	25	15.25

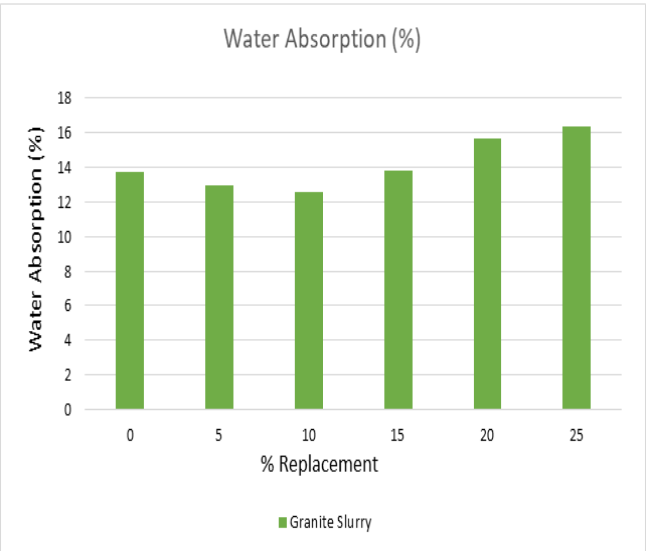

Fig 4 Variation of Water Absorption vs % Replacement of Granite Slurry

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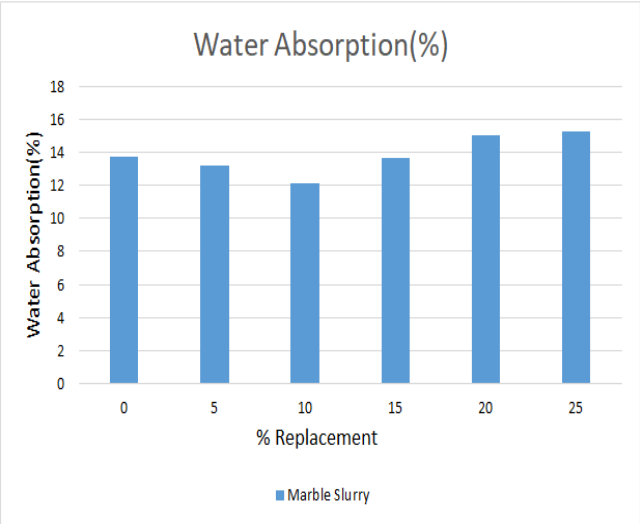

Fig 5 Variation of Water Absorption vs % Replacement of Marble Slurry

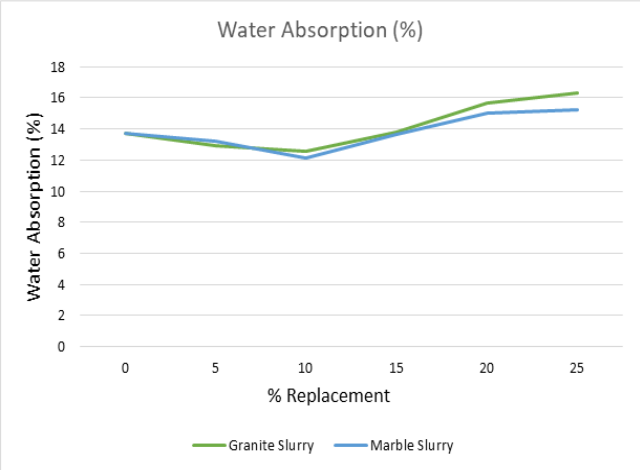

Fig 6 Comparison of Water Absorption

The above results show that compressive strength is maximum for granite slurry at 10% replacement and for marble slurry at 15%. It is also observed that compressive strength first increases and then decreases for both cases.

The percentage of water absorption is minimum at 10% replacement for both granite and marble slurry.

IV. CONCLUSION

It can be concluded that on increasing the percentage of replacement, compressive strength first increases and then decreases for both granite and marble slurry. The maximum compressive strength for granite slurry is at 10% replacement value and that of marble slurry is at 15% replacement value.

It can also be concluded that water absorption initially decreases and then increases with the percentage of replacement. Its minimum value is observed at 10% for both cases.

So, we can say that the optimum replacement value can be between 10-15%.

Lastly, it can be concluded that slurry waste can be utilized in clay brick to obtain better properties of bricks and reduce the exploitation of natural raw materials.

REFERENCES

[1]. Minor Minerals 30.11 Granite, 57th Edition, Indian Minerals Yearbook 2019 (Part-III: Mineral Reviews) issued by Government of India, Ministry of Mines, Indian Bureau of Mines. July 2021.
[2]. Nayak SK, Satapathy A, Mantry S. Use of waste marble and granite dust in structural applications: A review. Journal of Building Engineering [Internet]. 2022 Apr 1;46:103742.
[3]. Dhanjode C, Nag A. Utilization of landfill waste in brick manufacturing: A review. Materials Today: Proceedings [Internet]. 2022 Jan 1;62:6628–33.
[4]. Ngayakamo B, Komadja GC, Bello A, Onwualu AP. Valorization of granite micronized stones wastes for eco-friendly production of fired clay bricks. SN Applied Sciences [Internet]. 2021 Oct 19;3(11).
[5]. Hamid EMA. Investigation of using granite sludge waste and silica fume in clay bricks at different firing temperatures. HBRC Journal [Internet]. 2021 Jan 1;17(1):123–36.
[6]. Baghel R, Pandel U, Vashistha A. Manufacturing of sustainable bricks: Utilization of mill scale and marble slurry. Materials Today: Proceedings [Internet]. 2020 Jan 1;26:2136–9.
[7]. Munir MJ, Kazmi SMS, Wu YF, Hanif A, Khan MU. Thermally efficient fired clay bricks incorporating waste marble sludge: An industrial-scale study. Journal of Cleaner Production [Internet]. 2018 Feb 1;174:1122–35.
[8]. Bilgin N, Yeprem HA, Arslan S, Bilgin A, Günay E, Marşoğlu M. Use of waste marble powder in brick industry. Construction and Building Materials [Internet]. 2012 Apr 1;29:449–57.
[9]. Hamza RA, El-Haggar S, Khedr S. Marble and Granite Waste: Characterization and utilization in concrete bricks. International Journal of Bioscience, Biochemistry and Bioinformatics [Internet]. 2011 Jan 1;286–91.
[10]. IS: 3495(Part I to IV) 1992 Methods of tests on burnt clay building bricks.
[11]. IS: 2212–1991 Code of practice for brick work.