Review on Compressive Strength Characteristics of Brick with Partial Replacement of Cement and Lime by Using Granite Powder

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Abstract **- Brick is the most important building construction material which is widely used in residential and commercial structures. In load bearing structure the most important component of masonry walls is nothing but a brick. In this we studied about the different types of fly ash bricks, various ingredient materials and their proportion, Partial replacement of cement and lime with granite powder and their effects on different properties like compressive strength and water absorption. From this study, it has been concluded that use of granite powder as a partial replacement of cement is economical, ecofriendly and cost-effective.**

Index Terms **- fly ash brick, granite powder and compressive strength.**

I.INTRODUCTION

Today's demand is to consider the economic and environmental aspect of waste materials for the selection of construction material. Brick is the main material used in construction of buildings and one of the oldest. Development of different type of bricks using solid waste material is necessary. For wide production and application of these bricks not only technical, economic and environmental sectors but public education related to waste reusing and need for sustainable development should be done. Granite powder is one of the waste materials which can be used in brick manufacturing. Granite is widely used in construction purposes; both interior, exterior and would be required more as the construction industry is expanding constantly. Granite has to be cut to give a desired shape, which would further be installed as per the constructing needs. This cutting of granite generates a lot of powdered waste. According to the research, nearly one lakh cubic meters of granite powder is generated annually in India and has to be disposed of in landfills and top agricultural soil; because it cannot be discarded as the fact is that, they pollute the environment. This is not an eco-friendly solution for the problem caused by granite waste. Granite powder is a non-biodegradable waste that can easily affect the health of humans and animals and is also very harmful to the environment. These granite wastes are an efficient alternate option in the construction industry and a worthy solution for the environmental problems. For manufacturing fly ash bricks, the use of fly ash and granite powder is ecologically advantageous as it helps for saving the environment.

II. LITERATURE REVIEW

RINKU KUMAR, NAVEEN HOODA (2014): - This paper focused on the study of physical and mechanical properties of bricks. They were water absorption, hardness, efflorescence, soundness, shape and size, crushing strength and compressive strength. Prism test was conducted on different cement-sand mortar mixes of the ratios 1:3, 1:4 and 1:5. The mean moisture absorption percentage of clay brick and fly ash brick were found to be 11.93% and 9.77% respectively. The moisture absorbed by fly ash brick was 18.10% lesser than that of clay brick. 8.14 N/mm² and 18.81 N/mm² were the corresponding crushing strengths of clay brick and fly ash brick. The crushing strength for fly ash brick was 56.72% more than that of clay brick. All prism tests indicated that, the average increase in crushing strength for fly ash brick samples was 24.95% more than that of the clay brick samples.

PRAVIN P. GADLING, M. B. VARMA (2017): - They studied the optimum percentage of fly ash to be used with varying combination of materials in making bricks. Their effects on various properties of bricks were also discussed. The compressive strength of bricks increased after using fly ash (70% to 80%) in manufacturing bricks. The durability of brick also increased as lime combined well with fly ash. Manufacturing cost of brick decreased after using fly ash in it.

RANIA A. HAMZA et al., (2011): - They use marble and granite waste in manufacturing bricks by fully replacing conventional coarse and fine aggregates with marble waste scrapes and slurry powder. They tested the samples for compressive strength, moisture content, water absorption and durability. Their results concluded that marble and granite (slurry) cement bricks possess similar physical and mechanical properties. Cement bricks reached their optimum potential after substitution of 10% granite slurry. The requirement of Egyptian code for structural bricks was fulfilled by all the tested cement brick samples.

A. ARIVUMANGAI, T. FELIXKALA (2014): - They studied on the behavior of M30 grade concrete, by replacing sand with granite powder (0%, 25% and 50%) and partially replacing cement with fly ash, silica fume, super plasticizer and slag. They observed the compressive and split tensile strength of concrete after 28, 56 and 90 days respectively. In terms of strength and durability, the quality of concrete upgraded after using granite powder and admixtures as partial substitutions in concrete. It was observed that, the split tensile strength of concrete decreased after increasing the granite (powder) content in the mix beyond 25%.

Y. YASWANTH KUMAR et al., (2015): - In this investigation, Granite Slurry (GS) was used as a partial substitute in concrete. GS proportions varying from 5% to 20% by weight to cement were tested for flexural, compressive and tensile strength. It was observed that, substituting 10% of cement (by weight) with Granite Slurry in concrete increased the compressive strength from 35 N/mm² (of normal concrete) to 48 N/mm². Tensile strength also increased from 2.4 N/mm² (of regular concrete) to 3.6 N/mm². Flexural strength also increased from 3.2 N/mm² (of normal concrete) to 4.6 N/mm². It was also found that, after increasing the GS from 10% to 20% (by weight to cement), the reconfigured concrete attains similar strength as that of normal concrete. Thus, 20% substitution of GS was also effective. It was concluded that the tensile, compressive and flexural strengths of concrete were enhanced by replacing locally accessible Granite Slurry.

ABDUL BASIT et al., (2018): - This research was focused on partial replacement of cement with brick dust and lime powder. 20% substitution of brick dust and lime powder (by 5% interval) in concrete was done separately. The combinations used were, 5% brick dust with 15% lime powder; 10% brick dust with 10% lime powder and 15% brick dust with 5% lime powder. The control sample's compressive strength was more, but good workability was achieved by replacing 20% brick dust alone in concrete. By replacing 20% cement with lime powder, the compressive strength and split tensile strength increased (as compared to control mix). Contrasting to normal mix, the prime tensile and compressive strengths were achieved when 15% lime powder and 5% brick dust were substituted in cement. Their conclusion was that, by using lime powder and brick dust as partial replacements the cost of cement can be reduced by 7% to 12.5% (which eventually reduces the project cost).

T. FELIXKALA, P. PARTHEEBAN (2010): - In this paper, they studied the probable use of granite powder as a substitute to sand and partial substitution of cement with fly ash, silica fume, slag and super plasticizer in concrete. The percentages of granite powder added by weight were 0, 25, 50, 75 and 100 as a substitution to sand used in concrete and cement was partially substituted with 7.5% silica fume, 10% fly ash, 10% slag and 1% super plasticizer. The effects of water pond temperatures at 26°C and 38°C with 0.4 water-to-binder (w/b) ratios on mechanical properties, plastic and drying shrinkage strain of the concrete were studied and compared with natural fine aggregate concrete. The 'granite powder concrete' specimen's drying and plastic shrinkage values were no different from that of regular concrete specimens was the outcome of the conducted tests.

RAIZ AHMED et al., (2018): - In this investigation the tensile, compressive and flexural strength of concrete were tested after using Granite Slurry as fragmented replacement of cement by various portions ranging from 5% to 20%. The best result was found at 10% Granite Slurry substitution of cement by its weight. The compressive strength increased to 48

N/mm², as compared with 35 N/mm² of normal concrete. Similarly, the tensile strength increased to 3.6 N/mm², as compared with 2.4 N/mm² of conventional concrete. The flexural strength increased to 4.6 N/mm² from 3.2 N/mm² of normal concrete. It was also observed that, the addition of Granite Slurry beyond 10% (till 20%) resulted in the same strength. Therefore, a 20% substitution with Granite Slurry was also found effective.

LALIT KUMAR GUPTA et al., (2017): - This study focused on the use of two most common mortar mix ratios (1:4 and 1:6) by using granite powder (of 0.9 fineness modulus) as fine aggregate. The study was carried out in two stages. Substitution was made of 1.65 fineness modulus sand (ranging from 0% to 100%) by granite powder in the first stage. The water-cement ratio necessary for required workability jumped up to 2.3 (from 1.2), when granite powder replaced the river sand completely. The compressive strength decreased by 41%; whereas a rise of 56% was noted in the water absorption quantity. 30% and 40% were the respective volumes of fine aggregate which were substituted by granite powder in the second stage. Above properties were studied again. After which it was noted that, the reconfigured mix's compressive strength increased by 11% (contrasting with regular mix) and no change was observed in the water absorption quantity. They concluded that, the partial replacement of mortars by coarse sand and granite powder (30% and 40% volume of mortar) did not affect its mechanical properties negatively.

PAKI TURGUT (2012): - In this study, limestone powder, class C fly ash, silica fume and water were the only materials used in masonry brick production. 7, 28 and 90 days were the durations, for which the above materials were worked on. The density, water absorption, flexural strength, compressive strength, thermal conductivity and porosity of the bricks were recorded. Addition of surplus silica fume in the samples improved their compressive and flexural strength. By adding only silica fume (20%), the masonry blocks had achieved compressive strengths of 23 M Pa and 26.5 M Pa after curing for 28 and 90 days respectively. Traditional fired clay brick was found to be 6.4 times expensive than the new masonry brick; considering the estimated production cost.

B. T. SAPNA, M. ARAVINDHRAJ (2018): - In this study author discussed about compressive strength, split tensile strength and flexural strength of concrete when 0%, 5%, 10%, 15%, and 20% cement was replaced by red mud and 5% cement by hydrated lime. On contrasting with normal concrete, 15% substitution of red mud and 5% of hydrated lime the compressive strength had increased by 17% and split tensile strength by 23%. Red mud and hydrated lime's substitution in cement by 15% and 5% (respectively) were the most suitable replacements in concrete, as found by compressive strength of cubes and split tensile strength of cylinder.

N. SUNEEL KUMAR et al., (2017): - In this study, they did experiment with the use of lime powder in concrete mix by replacing cement partially. These replacements ranged from 0% to 30% (volume of cement) with a 10% interval. The grade of concrete they used for this study was M20 and a constant slump of 60 mm was maintained. After 7 days and 28 days they calculated the compressive strength and after 28 days they calculated the split tensile strength. By studying the results they concluded that 30% replacement (of cement by lime powder, in concrete) yielded maximum compressive strength, tensile strength and workability.

III. CONCLUSION

In this paper, we studied about the various types of bricks, their properties and mix proportion. Use of granite powder as partial replacement of cement in concrete gives better result that's why this study gives suggestion that, partial replacement of cement and lime with granite powder in brick will enhance the quality of brick. Also this study suggested that to protect the environment from industrial waste and to make the cost effective building material, use of waste in the production of building material will become more relevant at present time.

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