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EXPERIMENTAL INVESTIGATION OF HARDENED AND FLEXURAL STRENGTH PROPERTIES OF BRICK KILN DUST CONCRETE

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ABSTRACT

Sustainable resource management and development have been at the forefront of important issue concerning the construction industry since last decade. Specifically the use of sustainable building material and reuse waste materials in gaining importance and becoming common place in many areas. The present study consists of experimentation forhardened properties like compressive strength, split tensile strength and flexural test were carried out on Brick kiln dust concrete. The percentage of bricks kiln dust that partially and fully replaced by fine aggregates by weights were 0%, 10%, 20%, 30%, 40% and 50%. Experiments were conducted for both Ordinary Concrete and bricks kiln dust Concrete with different percentages of BKD. The experimental results and computational analysis have emanated up with a considerable outcomes.

I. INTRODUCTION

The growth in India's economy and population, coupled with urbanization, has resulted in an increasing demand for residential, commercial, industrial and public buildings as well as other physical infrastructure. *Building construction in India is estimated to grow at a rate of 6.6% per year between 2005 and 2030 (ASTM C 1585 - 04, 2007).* The building stock is expected to multiply five times during this period, consequently outsized demand for building materials.

Concrete is probably the most extensively used construction material in the world; only second to water as heavily consumed substance with about 10 billion tones being produced every year. This is largely due to the abundance of raw materials for concrete manufacture, low relative cost and adaptability of concrete in forming various structural shapes.The compressive strength is often considered as the sole benchmark for approving a concrete mix. The other properties of concrete, such as water permeability and chloride diffusion, that influence its durability, are rarely evaluated due to the fact that their determination is costly, cumbersome and time consuming compared to assessing the compressive strength. With increasing incidences of concrete deterioration, and increasing demand for durable structure, compressive strength alone cannot be considered as the only criterion for evaluating the quality of concrete. In the past few years, many research and modification has been done to produce concrete which has the desired characteristics. Concrete is now specified in terms of both strength and durability*(Corinaldesi, V, et.al, 2010).*

It is assumed that higher the compressive strength of concrete, better would be its durability. However, this assumption is not always true. A concrete mix satisfying the required strength may not necessarily be durable.

Concrete, whether containing natural or artificial aggregates is relatively brittle, and its tensile strength is typically only about one tenths of its compressive strength. Ordinary concrete is therefore normally reinforced with steel reinforcing bars. For many applications, it is becoming increasingly popular to reinforce the concrete with small, randomly distributed fibers. Their main purpose is to increase the energy absorption capacity and toughness of the material. But also the increase in tensile and flexural strength is often the primary objective.Similarly, now a days, several wastes from different modes of the industries are used to optimize the performance of concrete.

As India is the second largest producer of clay fired bricks, accounting for more than 10 percent of global production. India is estimated to have more than 100,000 brick kilns, producing about 150-200 billion bricks annually, employing about 10 million workers and consuming about 25 million tons of coal annually. India's brick sector is characterized by traditional firing technologies; environmental pollution; reliance on manual labour and low mechanization rate; dominance of small-scale brick kilns with limited financial, technical and managerial capacity; dominance of single raw material (clay) and product (solid clay brick); and lack of institutional capacity for the development of the sector. India is divided into three broad regions – northern mountainous region (counts very low percentage), Gangetic plain (counts 65 percent of the total brick production) and peninsula (counts almost 85 percent of the total brick production)*(IS 383-1970).*

In terms of potential applications of Brick Kiln Dust, It has been observed from the last practices that BKD is use for non-structural applications. Some of its non-structural applications are presented are:Stabilization of sludge, wastes, and contaminated soils, Soil stabilization, Land reclamation, Agricultural applications (fertilizer, liming agent), Livestock feed ingredient, Construction applications (use as a road base material), Sanitary landfill daily cover,Mineral filler, Lightweight aggregatesThe Brick Kiln Dust generated is being utilized by various other industries and have sufficient recycling values. The rest of the waste is being dumped on the roadside or in land filling causing environmental concerns. The presence of water bodies near the brick kilns also adds the high risk of water contamination and poses a threat to water ecology. With increasing restrictions on the landfills and increased concerns about environmental quality, effective waste management is being desired*(Radhikesh P, et.al., 2010).*

With this basic ideology, the present investigation have tried to sight out the compatibility of Brick kiln Dust with concrete. How the strength; in terms of compressive strength, splitting tensile strength and flexural strength differs with totalling of Brick kiln dust at various percentages.

II. INTERNATIONAL AND NATIONAL SCENARIO OF RESEARCH

The brief literature review presented here suggests a varied picture of research work carried in this field in the past few years.*(Zhi et.al, 2012);*studied the effect of clay-brick-powder (CBP) on concrete mechanical properties, including compressive strength, static elastic modulus, and flexural strength. The orthogonal experimental design method was used to study the significance sequence of all influencing factors, including water/cement pious material ratio, sand ratio, replacement level, and average particle size of the CBP. A total of 17 mixes were tested including one normal cement concrete as reference. The mixtures with CBP reach more than 50 MPa and 20 GPa for 28-day compressive strength and elastic modulus, respectively. The flexural strength ranged from 10 to 12 MPa. Experiment results showed that recycled CBP could be used as partial

replacement of cement in concrete. The optimal mix proportion was determined based on the experimental and orthogonal analysis.*(Khan A. et.al, 2014)*; studied wide variety of waste materials have been studied to produce bricks with different methods. The research can be divided into three general categories based on the methods for producing bricks from waste materials: ring, cementing and geopolymerization. Although much research has been conducted, the commercial production of bricks from waste materials is still very limited. The possible reasons are related to the methods for producing bricks from waste materials, the potential contamination from the waste materials used, the absence of reel**)** Bricks are a widely used construction and building material around the world. Conventional bricks are produced from clay with high temperature kiln firing or from ordinary Portland cement (OPC) concrete, and thus contain high embodied energy and have large carbon footprint. In many areas of the world, there is already a shortage of natural source material for production of the conventional bricks. For environmental protection and sustainable development, extensive research has been conducted on production of bricks from waste materials. This paper presents a state-of-the-art review of research on utilization event standards, and the slow acceptance of waste materials-based bricks by industry and public. For wide production and application of bricks from waste materials, further research and development is needed, not only on the technical, economic and environmental aspects but also on standardization, government policy and public education related to waste recycling and sustainable development. *(Sharda et.al, 2014)*;elaborated that these building construction is going rapidly with the rate of 6.6% from 2005 as projected increase in building area in India. So scarcities of constructional materials are going to increases and demand of building construction, road construction also increases. On the other hand in this paper we focused to find out the physical properties of waste brick kiln dust (B.K.D.) as a constructional material in civil engineering as partial replacement of OPC cement through various lab testing's like sieve analysis, specific gravity, optimum moisture content (OMC) and shear testing.*(Salman Siddique et.al 2015);*studied that the recent increase in infrastructure sector is resulting in increased production of bricks. The brick industry of India is managed by unskilled labour resulting in high amount of waste generation, the waste generated is a cause of environmental concern. Published research reports have indicated it as a viable material to be utilised in concrete industry. This paper presents an overview of the work done in earlier studies depicting the effect of brick dust on the properties of concrete.

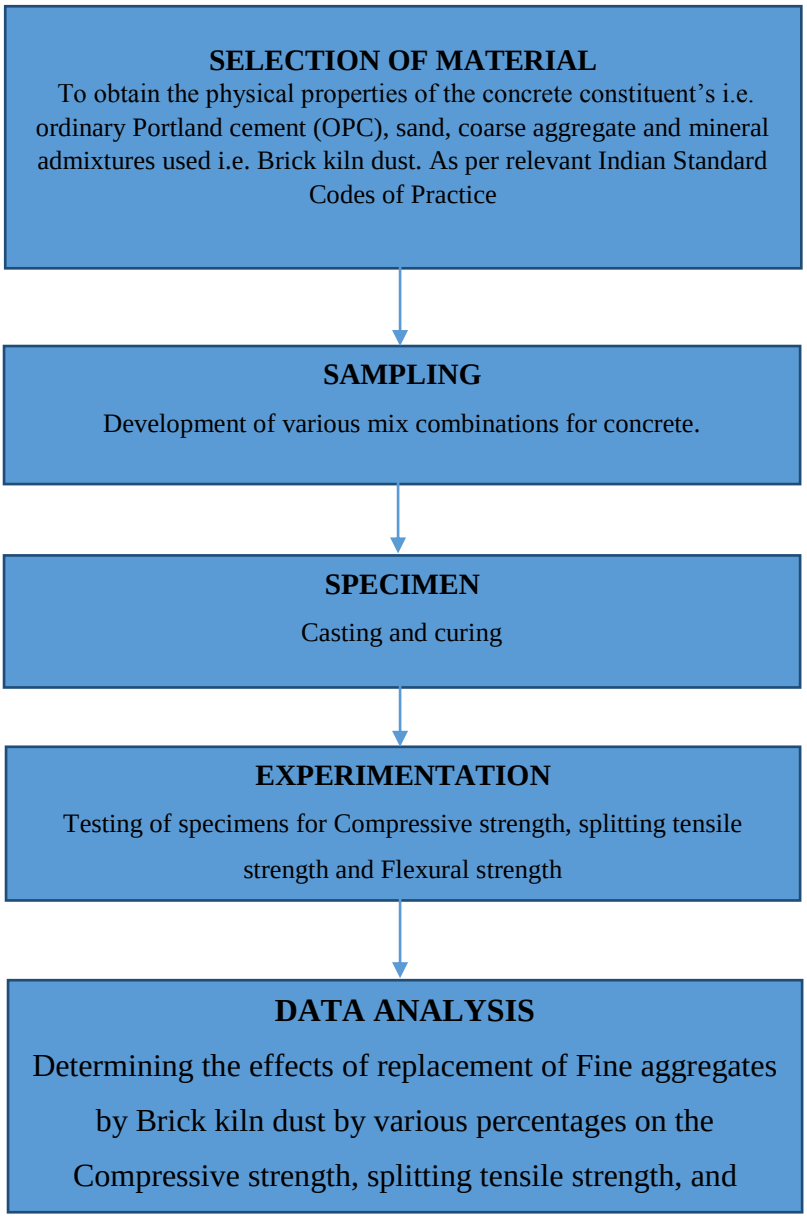
III. OBJECTIVE

The investigation is aimed to develop a concrete with good strength, less porous, so that good durability will be achieved. For this purpose, Brick kiln dust is used as a pozzolanic materials. Precisely;

1. The influence on the strength (*in terms of compressive strength, splitting tensile strength and flexural strength*) with the addition of brick kiln dust*(at various percentage by weight*) as a partial replacement of fine aggregate will be investigated.
2. Experiments for the initial surface absorption characteristics of concrete at different curing ages, have been performed.

IV. MATERIAL AND METHODS

To achieve the objectives, an extensive experimental suite was premeditated which included evaluation of compressive strength, tensile strength, flexural strength properties of concrete specimens containing different percentages of Brick Kiln Dust.The agenda of investigation for the strength of concrete is briefed in following flow-chart:



Compressive Strength test and splitting tensile strength was conducted on a 200T Compression Testing Machine, while the water permeation properties i.e. Initial Surface Absorption and Capillary Suction were performed as per BS-1881 208 and ASTM C 1585 – 04 respectively.

The percentage of bricks kiln dust that partially and fully replaced the fine aggregates by weights were 0%, 10%, 20%, 30%, 40% and 50%. Experiments were conducted for both Ordinary Concrete and bricks kiln dust Concrete with different percentages of BKD and at different curing ages.

From the computational analysis, it is perceived that the compressive, splitting tensile strength of concrete and flexural strength of concrete increases with addition of low Percentage of bricks kiln dust. The results show that

the optimum replacement of recycled bricks kiln dust with fine aggregates was 20%. Up to 20% replacement, it is possible to gain the same strength as conventional concrete. Beyond 20% replacement the strength results following a decreasing trend.

V. CONCLUSION

The strength development pattern of brick dust concrete is similar to that ofconventional concrete but there is increase in strength at all the curing ages. The utilization of mineral admixtures can be used to increase compressive strength at higher substitution levels. From the investigation, it is concluded that:-

1. Brick dust is the potential viable material to be used as fine aggregate to produce durable concrete.
2. Its use as fine aggregate in concrete will help in alleviating the potential problem of dwindling natural resources.
3. Its use will also help in protecting the environment surroundings.
4. All concretes mixes using brick kiln dust satisfied the strength criteria for fresh and hardened properties.
5. Good hardened properties were achieved for the concretes with 20% Brick Kiln Dust, which can be considered as the optimum content for high compressive strength

REFERENCES

[1] ASTM C 1585 -04 (2007) Standard test method for measurement of rate ofabsorption of water by hydraulic-cement concretes.

[2] Corinaldesi, V.,Moriconi, G., TarunNaik, R., (2010). Characterization of marble powder for its use in mortar and concrete. Construction and Building Materials 24 (2010) 113–117.

[3] Indian Standard IS 383-1970, Bureau of India Standards, ManakBhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.

[4] Radhikesh P, Nanda Amiya K. Das and Moharana.N.C 2010 “Stone crusher dust as a fine aggregate in Concrete for paving blocks” Internatinal journal of civil and structural engineering volume 1 , No 3, 2010 ISSN 0976 – 4399.

[5] Zhi, G., Gao. G., Sun, R., Zheng, L., (2012) Mix design of concrete with recycled clay-brick-

[6] powder using the orthogonal design method. Construction and Building Materials 31 (2012) 289–293. A. Khan, S. Ramzan, S. Arif, S. Danish, and M. Mushtaq, “Development of Green Concrete (GC) with Brick Dust Waste (BDW) and Natural Fertilizer of Municipal Solid Waste (NFMSW),” Journal of the Pakistan Institute of Chemical Engineers, Vol. 41(1), pp. 39-44,August 2013.

[7] Sharma S., Yadav S.K. “Waste Brick Kiln Dust as a Construction Material in Civil Engineering”, GJESR research paper vol. 1 [issue 8] September, 2014, ISSN:- 2349–283X.

[8] Siddique S., Siddiqui M.S., Khan S.M. , “Assessing the Scope of Utilizing Waste from Brick Production for Building Materials”, International Journal of Advanced Technology in Engineering and Science, Volume No 03, Special Issue No. 01, May 2015, ISSN (online): 2348 – 7550.

[9] Siddique S., Siddiqui M.S., Khan S.M. , “Assessing the Scope of Utilizing Waste from Brick Production for Building Materials”, International Journal of Advanced Technology in Engineering and Science, Volume No 03, Special Issue No. 01, May 2015, ISSN (online): 2348 – 7550.