



# Dynamic Properties Comparison with Replacements of Brick Powder, Metakaolin, Marble Powder in Concrete

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## Abstract:

Making and utilizing of a sustainable concrete has become an important requirement day by day. To reduce the environmental effect, several of supplementary cementing and pozzolonic materials are introduced and they are partial replacement of cement in the concrete. In this work I am using three materials in this work namely brick powder, marble powder and met kaolin as partially replacing with cement. Marble powder and brick powder both materials cheaply available in the India. Cement production creates environmental problems. So Marble powder, brick powder & metakaolin as partial replacement with cement in concrete. This Project reports the results of fresh and hardened properties of the concrete with partial replacement of marble powder brick & as well metakaolin, at various percentages at different curing periods, tests to be performed are destructive as well as non destructive and producing a good comparative results with these partial supplements in the mixture of concrete

**Keywords:** brick powder, metakaolin, marble powder, dynamic property.

## I. INTRODUCTION

Concrete is an artificial material in which the aggregates both fine and coarse are bounded together by the cement when mixed with water. The concrete has become so popular and indispensable because of its inherent characteristics and advantages either when green or hardened. The use of reinforcement in concrete has brought a revolution in applications, design and construction techniques. Its great versatility and relative economy in filling wide range of needs has made it a very competitive building material. The most important pozzolonic materials are fly ash, and metakaolin whose use in cement and concrete is thus likely to be a significant achievement in the development of concrete technology in coming few decades.

## II. LITERATURE REVIEW

**A.Talhaetal. (2015)** investigated the use of waste marble powder as partial replacement for cement in the production of concrete. A substitution of cement by 15% of waste marble powder increased mechanical properties, durability properties of concrete and reduction of chloride ion penetration and oxygen permeability. The Effect Of Iran's Metakaolin In Enhancing The Concrete Compressive Strength[2] This paper presents the performance of metakaolin (MK) on compressive strength and durability of concrete. Fired (calcined) MK has a very good pozzolanicity, which could be partially replaced with Portland cement. It can decrease permeability, increase compressive strength, and concrete durability. In this study, four different type of metakaolin which one of them was made in UK and the others were from different part of Iran were used **ONG, CHEE HUAT [10]** (2006) the study focuses on the compressive strength performance of the blended concrete containing different percentage of metakaolin. The cement is replaced accordingly with the percentage of 5 %, 10%, 15%, 20%, and 30% by weight. Concrete cubes are tested at the age of 1, 3, 7, and 28 days. In addition, the effect of calcination

temperature to the strength performance is included in the study. Finally, the strength performance of metakaolin-concrete is compared with the performance of concrete blended with silica fume and slag. The results show that the strength development of concrete blended with metakaolin is enhanced. It was found that 10% replacement appears to be the optimum replacement where concrete exhibits enhanced compressive strength at all ages comparable to the performance of SF and GGBS.

**BAI, JIPING, GAILIUS, ALBINAS [5]** Development of a multivariate statistical model for consistency parameter prediction including slump, compacting factor and vebe time for concrete incorporating FA and MK is described. The models constructed provide an efficient, quantitative, and rapid means for obtaining optimal solutions to consistency prediction for concrete mixes using PC-FA-MK blends as binder. Based on the experimental data, comprehensive regression analysis and significance tests were performed and the best-fit models for predicting consistency parameters were found. Values of consistency were calculated by the proposed models and gave a good agreement with observed experimental data. It indicates that the models are reliable, accurate and can be used in practice to predict the consistency of PC-FA-MK blends.

**A.K.MULLCK [3]** (2007) Described among the many factors that govern the durability and performance of concrete in service, type of cement receives greater attention. In his paper he describes the characteristics of cementitious systems required to meet the diverse requirements of strength and durability of concrete and highlights the advantages of part replacement of OPC by fly ash, granulated slag and silica fume- either singly or in combination in ternary blends.

## III. EXPERIMENTAL PROGRAM

Stage I: Procurement of materials and its testing

Stage II: Moulding of specimens and curing

Stage III: Testing of specimens

### PROPERTIES OF METAKAOLIN

S.No.	Property	Value
1	Specific Gravity	2.54
2	Accelerated pozzolanic active index, % of control	89
3	Residue on 45 micron sieve, %	1.31
	Chemical analysis	
4	Loss on Ignition	0.70
5	Silica (SiO <sub>2</sub> )	52.24
6	Iron Oxide (Fe <sub>2</sub> O <sub>3</sub> )	0.60
7	Aluminum (Al <sub>2</sub> O <sub>3</sub> )	43.18
8	Calcium Oxide (CaO)	1.03
9	Magnesium Oxide (MgO)	0.61

### Physical properties of Marble powder

S.No	Property	Value
1	Physical state	Fine powder
2	Odor	Odorless
3	Appearance	Free flowing
4	Color	Pure white
5	PH ( 5% solution )	6.0
6	specific gravity	2.6
7	Moisture	Below 0.5%
8	Oil absorption ml/100gm	18.20
9	Particle size	Below 90 microns

#### IV. SUPER PLASTICIZER

Super Plasticizers are new class of generic materials which when added to the concrete causes increase in the workability. They consist mainly of naphthalene or melamine sulphonates, usually condensed in the presence of formaldehyde. Super plasticizer concrete is a conventional concrete containing a chemical admixture of super plasticizing agent. As with super

plasticizer admixtures one can take advantage of the enhanced workability state to make reductions in water cement ratio of super plasticized concrete, while maintaining workability of concrete. Use of super plasticizer in RMC and construction reduces the possibility of deterioration of concrete for its appearance, density, and strength. On the other hand, it makes the placing of concrete more economical by increasing productivity at the construction site.

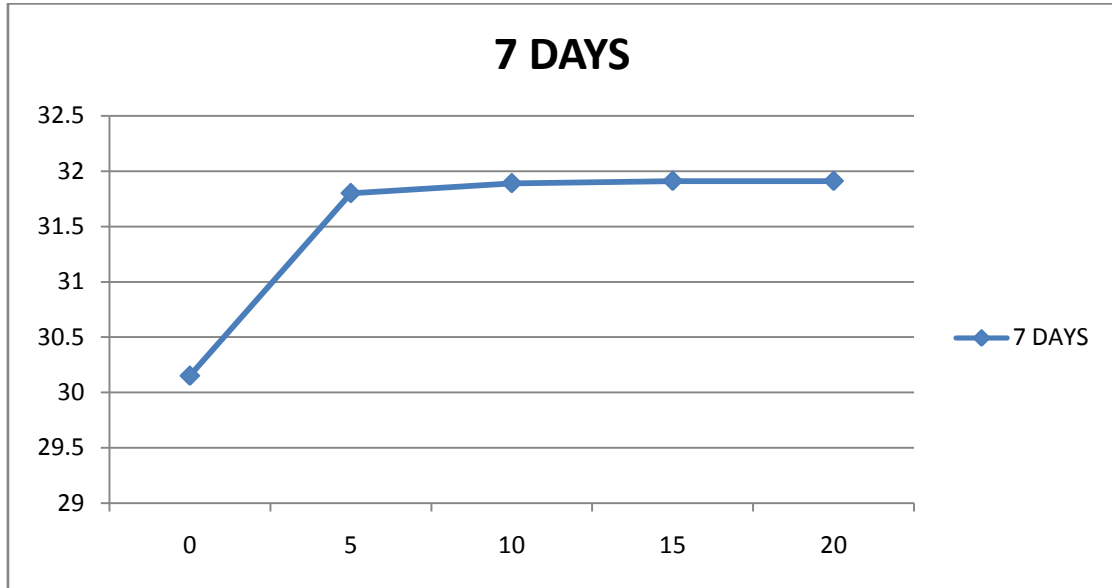
#### TEST RESULTS:

% of Metakaolin	7	28	56
0 %	28.9	48.18	51.4
5%	29.3	48.21	51.9
10%	29.6	48.30	52.3
15%	29.8	48.49	52.4
20%	30.2	48.52	53.00

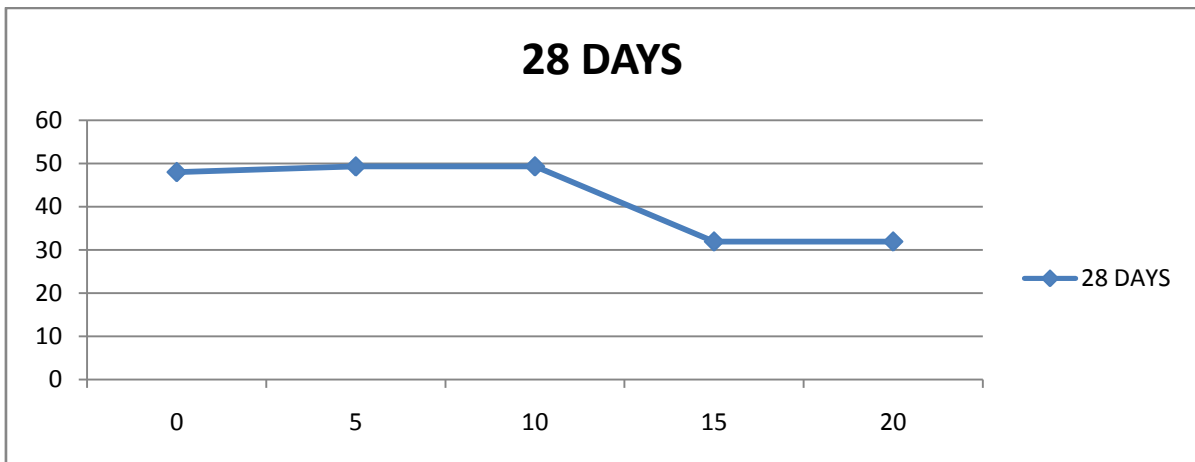
% of brick powder	7	28	56
0 %	28.4	48.19	49.21
5%	25.4	46.00	49.8
10%	25.6	46.32	49.3
15%	25.91	46.9	49.12
20%	25.91	47.3	49.14

% of MARBLE POWDER	7	28	56
0 %	28.9	48.19	49.21
5%	29.3	49.00	50.12
10%	29.8	49.12	51.1
15%	30.2	49.31	51.6
20%	30.12	49.35	51.8

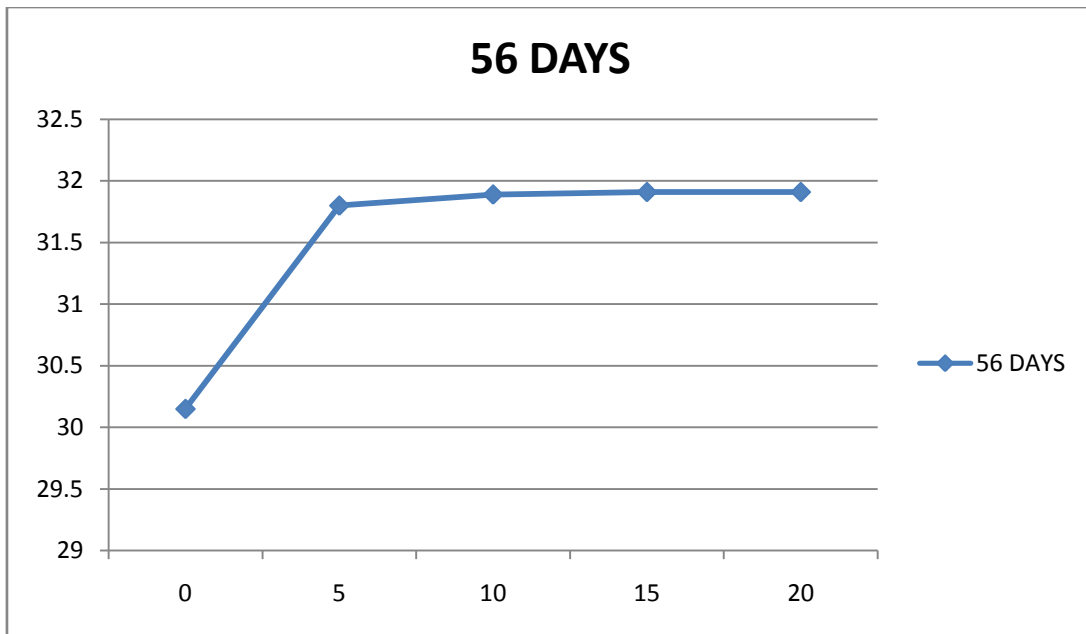
% of METAKAOLIN + BRICK POWDER + MARBLE POWDER			7DAYS
0 %	0 %	0 %	30.15
5%	5%	5%	31.80
10%	10%	10%	31.89
15%	15%	15%	31.91
20%	20%	20%	31.91



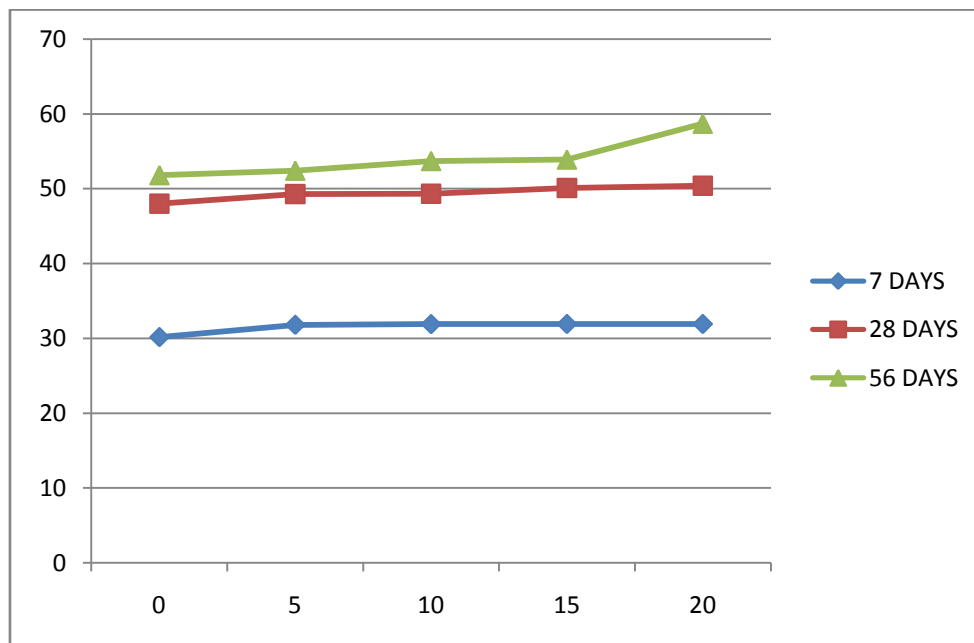
% of METAKAOLIN + BRICK POWDER + MARBLE POWDER			28 DAYS
0 %	0 %	0 %	48.00
5%	5%	5%	49.3
10%	10%	10%	49.32
15%	15%	15%	50.12
20%	20%	20%	50.4



% of METAKAOLIN + BRICK POWDER + MARBLE POWDER			56
0 %	0 %	0 %	51.8
5%	5%	5%	52.4
10%	10%	10%	53.7
15%	15%	15%	53.9
20%	20%	20%	58.7



COMBINED GRAPH) (% of METAKAOLIN + BRICK POWDER + MARBLE POWDER)



ULTRASONIC PULSE VELOCITY:

S NO	% OF METAKAOLIN+BRICK POWDER+MARBLE POWDER	Obtained velocity(m/s)	Quality of Concrete
1	0	4570	Excellent
2	5	4579	Excellent
3	10	4794	Excellent
4	15	4798	Excellent
5	20	4800	Excellent

## V. DISCUSSIONS

The following conclusions have been arrived from the study:

- 1) Metakaolin is an effective pozzolona and results in enhanced early strength and ultimate strength of concrete.
- 2) The compressive strength of young concrete, i.e., 7 days is improved by blending the OPC with 10%, 15 %, and 20 % of met kaolin by weight.

3) The 10% replacement with metakaolin is the most optimum replacement, enhancing the concrete's compressive strength at all ages.

4) The 28-days compressive strength of concrete was improved by partial replacements of OPC by metakaolin in the range up to 10% by weight, and was at the 20% level still maintained. The highest 28-days strength improvement of concrete can be expected at partial replacements in the 10-15% range.

- 5) The combined use of metakaolin and a super plasticizer allowed increasing the aforementioned partial replacement levels, i.e. to 20% in the case of maintaining strength.
- 6) Ternary blending by Metakaolin in combination with BRICK, & marble powder was found leading to further technical improvements to concrete strength.
- 7) Brick powder is low cost material which is useful to cast concrete slabs and further when combined with the ternary blends.
- 8) The split tensile strength results are also satisfactory when replacements of MATERILAS (METAKAIOLIN, BRICK POWDER, & MARBLE POWDER)
- 9) Non-destructive test also gives the optimum results when tested
- 10) Overall performance of the concrete is very good with three replacements.
- 11) Only disadvantage is three partial supplements for fine aggregate.

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