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Improving Properties of Concrete Replacing Cement and Natural Sand with Metakolin and Robo Sand

Jyoti Rani[1], Shashi Sharma[2], Vikram Dhillon[3]

[1]M.Tech Scholar, [2]Assistant Professor, [3]Head of Department
[1,2,3]Department of Civil Engineering, JCDMCOE, Sirsa, Haryana, India

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ABSTRACT

Concrete is the most extensively used construction material in the world, which consumes natural resources like lime, aggregates and water. The worldwide production of cement has greatly increased, due to this production environmental pollution increases with emission of CO2 gas. To reduce this effect cement was replaced by some supplementary materials like Metakaolin, Fly ash, Bottom Ash, Ground Granulated Blast Furnace Slag (GGBS) and Rice Husk etc.. In this content Metakaolin was a pozzolanic material used in wide range in replacement of cement. Metakaolin is dehydroxylated aluminum silicate, due to its pozzolanic activity the strength properties and durability properties of concrete increases and reduction in Porosity and Permeability also. Now-a-day's availability of natural sand is constraint, so alternative material called ROBO Sand (having similar properties as that Natural Sand) is used in place of Natural sand to study the fresh and hardened properties of concrete. In this present investigation cement is replaced partially with metakaolin in varying percentage i.e. 0%, 6%, 12%, 18% and 24% and natural sand with 45% ROBO sand to get the different concrete mixes. The fresh and mechanical properties of concrete i.e. workability (slump test) and compressive strength, split tensile strength and flexural strength at 7 days, 28 days and 56 days are studied of the different concrete mixes and results are compared with conventional concrete.

Keywords: *Metakaolin, Robo sand, Flexural strength, Split tensile strength, Compressive strength*

I. INTRODUCTION

Concrete isn't found in nature the manner in which we would discover aluminum, nickel or iron. Concrete is a composite structure material framed from joining bond with sand, smashed shake and water. Concrete is utilized more than some other man-made material on the planet. The qualities quality of cement relies on the properties of material and their joined activity. In the generation of bond CO_2 gas emanation is increasingly, because of these outcomes in harm of characteristic climatic conditions. To lessen the utilization of bond halfway supplanting of concrete with some advantageous cementations materials like Metakaolin, fly-fiery remains, base powder, rice husk, GGBS and silica rage and so forth., are utilized in solid blend. Metakaolin is a dehydroxylated type of dirt mineral Kaolin. Stone having high level of kaolinite are known as china mud or kaolin was customarily utilized in assembling of porcelain for example earthenware material.

II. Review of Literature

L. Vyshnavi Sai, T.Yeswanth, M.Sambasiva Rao and Murthy *et al.* (2015) Experimentally located that impact of Metakaolin in concrete with partial substitute of cement for M30 grade concrete. Supplementary cementitious substances are finely floor stable substances which are used to update a part of cement in concrete mix. Metakaolin is a dehydroxylated aluminum silicate. From the recent research paintings the usage of Metakaolin it's far evident that it's far a completely powerful Pozzolanic fabric which enhances the strength parameters. due to this the compressive electricity was steadily increased up to 11% substitute of cement and for 20%, 30%, forty% and 70% alternative of Metakaolin power is reduced.

Nikhil K. Kulkarni *et al.* (2015) evaluated the power of simple concrete with partial alternative of cement by way of Metakaolin and Fly ash. On this observe alternative of 13 cement with Metakaolin and Fly ash at zero%, 5%, 10% and 15% and the compressive strength and flexural strength take a look at changed into performed for 7and 28 days and as compared outcomes with regular concrete. Up to 10% substitute of cement with MK and Fly ash energy become expanded and for 15% decreased.

III. Methodology

In this study following test are carried out-

a. Compressive strength test
b. Split tensile strength test
c. Flexural strength test

IV. Test RESULT

1. Workability

The effect of Metakaolin and ROBO sand on fresh property concrete on workability shown in table

WORKABILITY OF M30 GRADE CONCRETE

S.No	Mix Designation	Slump value
1	Control Mix (M)	85 mm
2	0% MK (M_1)	66 mm
3	6% MK (M_2)	60 mm
4	12% MK (M_3)	53 mm
5	18% MK (M_4)	41 mm
6	24% MK (M_5)	18 mm

It show the workability of concrete decrease as the perctanage of the Metakaolin will be increase.

1. Compressive strength

COMPRESSIVE STRENGTH AT 7 DAYS, 28 DAYS AND 56DAYS

S.No	Mix Designation	Compressive Strength at 7 days (N/mm²)	Compressive Strength at 28 days (N/mm²)	Compressive Strength at 56 days
1	Control Mix (M)	19.66	33.11	37.40
2	0% MK (M_1)	20.56	33.92	38.32
3	6% MK (M_2)	24.66	34.62	39.05
4	12% MK (M_3)	25.76	36.02	41.15
5	18% MK (M_4)	23.26	34.13	38.50
6	24% MK (M_5)	21.40	32.18	36.60

Compressive strength at different percentage of Metakaolin shown in table. It shows that compressive strength will be increase as the percentage of Metakaolin will be increase up to 12 %. After this addition of Metakaolin compressive strength will not increase.

2. Split Tensile strength

The effect of Metakaolin and ROBO sand used in the present study on Split Tensile strength of concrete for M30 grade of different percentage 0%, 6%, 12%,18% and 24% of Metakaolin shown in table

SPLIT TENSILE S T R E N G T H AT different days

S.No	Mix Designation	Split Tensile Strength at 7-days (N/mm²)	Split Tensile Strength at 28-days (N/mm²)	Split Tensile Strength at 56-days (N/mm²)
1	Control Mix	2.75	3.33	3.60
2	0% MK (M_1)	2.85	3.40	3.70
3	6% MK (M_2)	2.96	3.60	3.89
4	12% MK (M_3)	3.12	3.96	4.26
5	18% MK (M_4)	3.00	3.70	3.84
6	24% MK (M_5)	2.93	3.62	3.68

Split tensile strength also increase up to 12 % of Metakaolin will be increase after that strength will be decreased.

3. Flexural Strength

The effect of Metakaolin and ROBO sand at various perctanage shown in table

FLEXURAL STRENGTH AT 7-DAYS and 28-DAYS AND 56 DAYS

S.NO	Mix Designation	Flexural Strength at 7-days (N/mm²)	Flexural Strength at 28-days (N/mm²)	Flexural Strength at 56-days (N/mm²)
1	Control Mix (M)	1.13	1.46	1.56
2	0% MK (M_1)	1.08	1.42	1.50
3	6% MK (M_2)	1.15	1.56	1.64
4	12% MK (M_3)	1.22	1.67	1.74
5	18% MK (M_4)	1.06	1.46	1.56
6	24% MK (M_5)	0.99	1.32	1.42

Flexural strength will be increase when Metakaolin perctanage increase up to 12 % after it decrease.

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