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MECHANICAL PROPERTIES ONPERMEABLECONCRETEWITHDOLOMITE

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ABSTRACT

In this project, permeable concrete will be examined that is created with only coarse particles and no fine aggregates. Increased groundwater recharge, thermal insulation, and noise absorption are all benefits of permeable concrete pavement. Permeable concrete's mechanical and durability characteristics have been attempted to be studied. In this investigation, 1:4 and 1:5 cement to coarse aggregate ratio is used, with respective water binder ratios of 0.33 and 0.34. For each of these mixtures, fly ash is used in place of 0%, 10%, 20%, and 30% of the cement. Compressive strength , split tensile strength and Ultrasonic pulse velocity tests for 28 and 56 days were conducted The more conventional cement concrete was used to determine the results. With the addition of dolomite, it was determined that the mix 1:5 with a replacement of 20% fly ash at a w/c ratio of 0.33 and 0.34 was the most effective.

KEY WORDS: ***Permeable Concrete, Dolomite, Flyash, Compressive strength and Split tensile strength.***

1. INTRODUCTION

Portland cement, water, and fine aggregate make up the majority of concrete, which is a composite material. These components join together to form a workable paste that gradually gets more difficult over time. Fine aggregate is a hard, chemically inert grain that is linked together with cement and water to form a structural component used in construction.

Coarse aggregate, cement and other cementitious materials, admixtures, and water are the ingredients of permeable concrete (PC). For concrete flat work applications, a special type of concrete called permeable concrete with a high porosity is employed. Concrete that is permeable allows direct passage of water and air from

precipitation and other sources, reducing runoff from a site and facilitating groundwater recharge. This kind of concrete is also known as porous concrete, pervious concrete, no-fines concrete, and porous pavement. The usage of permeable concrete is expanding due to its effectiveness in lowering pollutants, decreased demand for storm sewers, improved road safety due to increased skid resistance, and recharging to local aquifers.

Dolomite is an anhydrous calcium magnesium carbonate mineral. The term "dolostone" is occasionally used used to describe the dolomitic rock variety. Dolomite is used to manufacture magnesium in addition to being a source of magnesium oxide and concrete aggregate and functioning as an attractive material.

Fly ash is a by-product of coal combustion and a naturally cementitious material. Fly ash is taken out of the precipitators installed in the smokestacks of coal-burning power plants to reduce pollution. Due to the rising need for coal and power, more thermal power plants are anticipated in the near future. Fly ash takes on a spherical shape and solidifies as a suspension in the exhaust gases. Fly ash mostly consists of silica (SiO2), alumina (Al2O3), and iron oxide (Fe2O3).

2. OBJECTIVES

The objectives of this study as follows,

a) To make flyash cement as efficient as possible.
b) To enhance the dolomite admixtured permeable concrete.
c) To assess the results of the compressive , splittensile strength tests and Upv.

3. MATERIALS:

a. Cement: Since it sets and the Cement is often employed as a binder in concrete because it sets and hardens to bind other materials together. OPC (ordinary Portland cement), grade 53, is used in construction.
b. Fine aggregate: Potable water available in laboratory was used for casting all specimens in this investigation. The quality of water was found to satisfy the requirements of IS: 456 – 2000.
C. Water: All of the specimens utilised in this experiment were cast using potable water that was on hand in the lab. It was determined that the water quality met the requirements of IS: 456 - 2000.
d. Flyash: Fly ash is the non-combustible mineral component of coal. Coal is first processed into a fine powder before being utilised in a power plant.
e.Dolomite: Dolomite is, after limestone, the most common carbonate mineral. It makes up the majority of sedimentary and metamorphic rocks. Additionally, it is commonly found in hydrothermal deposits. Dolomite, which is mined to make building stone, road construction, and refractory bricks, is the principal source of magnesium metal.

4. RESULTS AND DISCUSSIONS:

Compressive strength test: The 150mm x 150mm x 150mm cube specimens were cast and put to the test in a compression testing apparatus for cure times of 7 and 28 days using different concrete mix quantities.

Table 1: Compressive strength results for permeable concrete partial replacement of cement with fly ash (1:4mix) and (1:5 mix)

mix	% of flyash	Compressive strengthresults(N/mm^2),28days		Compressive strengthresults(N/mm^2),56 days	
		0.33w/c	0.34w/c	0.33w/c	0.34w/c
1:4	0	18.42	19.58	19.94	21.33
	10	23.81	25.32	25.89	27.48
	20	24.81	26.35	26.95	28.51
	30	23.19	24.50	25.21	26.69
1:5	0	16.51	17.39	17.89	18.91
	10	21.47	22.43	23.38	25.95
	20	22.33	23.30	24.21	26.27
	30	20.82	21.73	22.58	24.44

Table 2: Compressive strength results for permeable concrete by partial replacement of cement with 20% of Fly ash+% of Dolomite(1:4mix)

MIX	20% ofFly ash+% ofDolomite	Compressive strengthresults(N/mm^2),28 days		Compressive strengthresults(N/mm^2), 56 days	
		0.33w/c	0.34w/c	0.33w/c	0.34w/c
1:4	20%FA+0%Dol	24.81	26.35	27.01	28.69
	20%FA+6%Dol	26.11	27.71	28.43	30.10
	20%FA+12%Dol	28.02	29.76	30.44	32.41
	20%FA+18%Dol	27.19	28.87	29.56	31.33

Split tensile strength: At the age of 7 and 28days, the cylindrical specimens (150mm diameter x 300mm height) weretestedforevaluatingthesplittensilestrength.Theexperimentisperformedbyputtingacylindricalsamplehorizontallyb etweenacompressiontestingmachines.

Table 3: Split tensile strength results for permeable concrete partial replacement of cement with fly ash (1:4mix) and (1:5 mix)

Mix	%of flyash	Split tensile strengthresults(N/mm^2) ,28days		Split tensile strengthresults(N/mm^2) ,56days	
		0.33w/c	0.34w/c	0.33w/c	0.34w/c
1:4	0	1.80	1.92	1.94	2.08
	10	2.35	2.51	2.55	2.72
	20	2.47	2.62	2.67	2.84
	30	2.31	2.44	2.53	2.62
1:5	0	1.62	1.71	1.76	1.88
	10	2.12	2.22	2.36	2.41
	20	2.28	2.31	2.48	2.53
	30	2.06	2.15	2.23	2.34

Table 4: Split tensile strength results for permeable concrete by partial replacement of cement with 20% of Fly ash+% of Dolomite(1:4mix)

Mix	20% of Flyash+% ofDolomite	Split tensile strengthresults(N/mm^2),28 days		Split tensile strengthresults(N/mm^2),56 days	
		0.33w/c	0.34w/c	0.33w/c	0.34w/c
1:4	20%FA+0%Dol	2.26	2.44	2.45	2.64
	20%FA+6%Dol	2.44	2.61	2.65	2.83
	20%FA+12%Dol	2.71	2.86	2.94	3.09
	20%FA+18%Dol	2.61	2.81	2.83	3.04

C.ULTRA SONIC PULSE VELOCITY TEST: An ultrasonic pulse velocity test is an in-situ, non destructive test to check the quality of concrete and natural rocks. In this test, the strength and quality of concrete or rock is assessed by measuring the velocity of an ultrasonic pulse passing through a concrete structure or natural rock formation**.**

Table5: UltraSonic PulseVelocityTest forFlyAsh AndDolomite (0.33 W/C)

S no	20% of Flyash+% ofDolomite	Pulse velocity (m/s) for 0.33 w/c	Concrete Quality
1	20%FA+0%Dol	4310	Good
2	20%FA+6%Dol	4478	Good
3	20%FA+12%Dol	4615	Excellent
4	20%FA+18%Dol	4559	Excellent

Table6:UltraSonic PulseVelocityTest forFlyAsh AndDolomite (0.34 W/C)

S no	20% of Flyash+% ofDolomite	Pulse velocity (m/s) for 0.34 w/c	Concrete Quality
1	20%FA+0%Dol	4425	Good
2	20%FA+6%Dol	4583	Good
3	20%FA+12%Dol	4591	Excellent
4	20%FA+18%Dol	4509	Excellent

5. CONCLUSION:

1. Thecompressivestrengthof1:4mixpermeableconcretewithcement replacedwith0% fly ash for 0.33water cement ratio which gives compressive strength values for 28days and 56 days are given as18.42 N/mm^{2}and 19.94 N/mm^2.
2.Thecompressivestrengthof1:4mixpermeableconcretewithcement replacedwith0% fly ash for 0.34water cement ratio which gives compressive strength values for28daysand 56 days are given as 19.58 N/mm^{2}and 21.33N/mm^2.
3. The compressive strength of 1:4 mix permeable concrete with cement replaced with20% fly ash for 0.33 water cement ratio which gives compressive strength values for 28daysand 56 days are given as 24.81 N/mm^{2}and 26.95N/mm^2.
4. The compressive strength of 1:4 mix permeable concrete with cement replaced with20% fly ash for 0.34 water cement ratio which gives compressive strength values for 28daysand 56 days are given as 26.35 N/mm^{2}and 28.51 N/mm^2.
5. Thecompressivestrengthof1:5mixpermeableconcretewithcement replacedwith0% fly ash for 0.33water cement ratio which gives compressive strength values for 28daysand 56 days are given as 16.51N/mm^{2}and 28.51 N/mm^2.
6. Thecompressivestrengthof1:5mixpermeableconcretewithcement replacedwith0% fly ash for 0.34water cement ratio which gives compressive strength values for 28daysand 56 days are given as 12.05 N/mm^{2}and 17.89 N/mm^2.
7. The compressive strength of 1:5 mix permeable concrete with cement replaced with20% fly ash for 0.33 water cement ratio which gives compressive strength values for 28daysand 56 days are given as 22.33 N/mm^{2}and 24.21 N/mm^2.
8. The compressive strength of 1:5 mix permeable concrete with cement replaced with20% fly ash for 0.34 water cement ratio which gives compressive strength values for 28daysand 56 days are given as 23.30 N/mm^{2}and 26.27 N/mm^2.
9. The compressive strength of 1:4 mix permeable concrete with cement replaced with

20%flyashadditionaladdingdolomite12%for0.33watercementratiowhichgivescompressivestrengthvaluesfor28daysand 56 days aregivenas28.02N/mm^{2}and 30.44N/mm^2.

10. The compressive strength of 1:4 mix permeable concrete with cement replaced with 20%flyashadditionaladdingdolomite12%for0.34watercementratiowhichgivescompressive strength values for 28daysand 56 days are given as29.76N/mm^{2}and 32.41 N/mm^2.

11. The split tensile strength of 1:4 mix permeable concrete with cement replaced with 0%fly ash for 0.33 water cement ratio which gives compressive strength values for 28daysand 56 days are given as1.80 N/mm^{2}and 1.94 N/mm^2.

12. The split tensile strength of 1:4 mix permeable concrete with cement replaced with 0%fly ash for 0.34 water cement ratio which gives compressive strength values for 28daysand 56 days are given as1.92 N/mm^{2}and 2.08 N/mm^2.

13.The split tensile strength of 1:4 mix permeable concrete with cement replaced with 20%fly ash for 0.33 water cement ratio which gives compressive strength values for28daysand 56 days are given as 2.47 N/mm^{2}and 2.67 N/mm^2.

14.The split tensile strength of 1:4 mix permeable concrete with cement replaced with 20%fly ash for 0.34 water cement ratio which gives compressive strength values for 28daysand 56 days are given as 2.62 N/mm^{2}and 2.84 N/mm^2.

15.The split tensile strength of 1:5 mix permeable concrete with cement replaced with 0%fly ash for 0.33 water cement ratio which gives compressive strength values for 28daysand 56 days are given as 1.62 N/mm^{2}and 1.76 N/mm^2.

16.The split tensile strength of 1:5 mix permeable concrete with cement replaced with 0%fly ash for 0.34 water cement ratio which gives compressive strength values for 28daysand 56 days are given as1.71 N/mm^{2}and 1.88 N/mm^2.

17.The split tensile strength of 1:5 mix permeable concrete with cement replaced with 20%fly ash for 0.33 water cement ratio which gives compressive strength values for 28daysand 56 days are given as 2.28 N/mm^{2}and 2.48 N/mm^2.

18.The split tensile strength of1:5mix permeable concrete with cement replaced with 20%fly ash for 0.34 water cement ratio which gives compressive strength values for 28daysand 56 days are given as2.31 N/mm^{2}and 2.53 N/mm^2.

19.The split tensile strength of 1:4 mix permeable concrete with cement replaced with 20%fly ash additional adding dolomite 12% for 0.33 water cement ratio which gives splittensilestrengthvaluesfor28daysand 56 daysaregivenas2.71N/mm^{2}and 2.94 N/mm^2.

20.The split tensile strength of 1:4 mix permeable concrete with cement replaced with 20%fly ash additional adding dolomite 12 % for 0.34water cement ratio which gives splittensilestrengthvaluesfor28daysand 56 daysaregivenas2.86N/mm^{2}and 3.09 N/mm^2.

21.The compressive strength of 1:4 mix permeable concrete with cement replaced with 20%flyashadditionaladdingdolomite12%for0.33watercementratiowhichgivesUltrasonic pulse velocity valuesfor28days 4615is m/s.

22.The compressive strength of 1:4 mix permeable concrete with cement replaced with 20%flyashadditionaladdingdolomite12%for0.34watercementratiowhichgivesUltrasonic pulse velocity valuesfor28days is 4591 m/s.

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