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Properties of Ordinary Concrete by Use of Stone Dust and Fly-ash

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Abstract:
The compressive strength of concrete increased when the cement, sand, and aggregate are proper bonded together. Stone dust is a waste material obtained from stone crushing units. Stone dust is used in W.B.M road for proper bonding of coarse aggregate. Fly – ash is a by- product obtained from thermal power plant in large amount. When fly ash is mixed with cement, fly ash gain the property same as cement. Most of research work was done by using fly ash as replacement of cement. In this experiment stone dust and fly ash is used in concrete and find the behavior of concrete. The primary aim of the use of stone dust and fly ash to make economical structure with specified strength. In this experiment Sand is partially replaced by stone dust and cement is partially replaced by fly ash. Percentage of sand replacement by stone dust is 15%, 30%, 45%, 60% and percentage of cement replacement with fly ash is 5%, 10%, 15%, 20%. For determination of workability of concrete slump test used. The concrete are examine for compressive strength and compare with conventional concrete of grade M20. All test on concrete are carried out according to IS code specification.

1. INTRODUCTION

Conventional concrete consist of cement, sand and aggregate. In concrete generally river sand is used which is costly but by inclusion of fly ash in place of cement and stone dust in place of sand in some percentage it make economical construction. Fly ash is also a type of admixture which enhances some properties on concrete. The size of stone dust is small as compare to sand which fill the maximum voids and make concrete more dens. In place where source of sand are not available and for construction work sand becomes uneconomical. The properties of concrete with stone dust and fly ash are obtained in this experiment.

2. LITERATURE REVIEW

Dr. P.B. Sakthivel Professor of Civil Engineering in the Department of Civil Engineering, Jerusalem College of Engineering (Affiliated to Anna University, Chennai), Tamil Nadu, India. He investigated practically and concluded that 20% of sand replaced with stone dust is more effective to increase the strength of concrete. Suman Anil Kumar, M.Tech. Student and Saxena Anil Kumar, Associate Professor Department of Civil, Lakshmi Narayan College of Technology, Bhopal. India. He work on inclusion of fly ash in concrete. He replaces the cement 5% to 50% and concluded that 10% replacement of cement is more suitable for concrete and increases Compressive strength of concrete. Priyanka A., Jadhav, Dilip K. Kulkarni investigated that the effect of water cement ratio on properties of cement mortar with partial replacement of river sand by stone dust in designed mortar mix having proportion as 1:2, 1:3 and 1:6 with water cement ratio of 0.5 and 0.55 . He suggested that mortar with 50% replacement of river sand by stone dust give more strength as compared the normale mortar. HanifiBinici, Hasan Kaplan and SalihYilmaz, provides some mechanical properties concrete containing marble dusts (MD) and limestone dust investigated practically. Seven concrete mixtures were produced in three series with control mixes having 400kg cement content. These control mixes were modified to 5, 10 and 15% MD and LD in place of river sand. The compressive strength of concrete observed by him after 7, 28, 90 and 360 days. A. Krishnamoorthi, and G. Mohan Kumar suggested that the use of fly ash and stone dust in concrete will make the concrete by using their properties in a beneficial way. The decrease in early strength by the addition of fly ash is compensated by addition of stone dust .The decrease in workability by the addition of stone dust is reduced by the addition fly ash. In his experiment workability and strength characteristics of stone Dust Concrete containing 0% to 30% of fly ash are obseved. Based on his experiment he concluded that combined use of stone dust and fly ash can be shown improved strength in concrete and also preserve the environment.

3. MATERIAL AND METHOD

3.1 Coarse aggregate

Figure.1. Coarse aggregate

20mm nominal size of coarse aggregate is used for experiment. For gradation of coarse aggregate IS 383:1970 used. For

obtained the mechanical property of coarse aggregate IS: 2386-1963 Part- III used.

Table.1. Properties of coarse aggregate

Sl. No.	property	value
1	Specific gravity	2.73
2	Water absorption	1.5%

3.2 Fine aggregate

Figure.2. Sand

Generally the size of aggregate which is passing through 4.75 mm sieve size is called fine aggregate. For determination of properties of fine aggregate IS2386-1963 (part III) is used the gradation of sand is done as per IS 383: 1970.

Table.2. Properties of sand

Sl. No.	property	value
1	Specific gravity	2.63
2	Sieve analysis	ZONE- II

3.3 Cement

For making of concrete ordinary Portland cement of grade 43 are used. Testing of cement is don according to IS: 431(part IV)-1988. The property of cement is shown below –

Table.3.Properties of cement

Sl. No.	property	value
1	Consistency of cement	34%
2	Setting time a) Initial b) Final	 45 minute 600 minute
3	Specific gravity	3.15
4	Fineness test	5%

Fineness of cement is necessary for make suitable Gel of cement during hydration process. Size of cement is a factor which affects the rate of hydration.

3.4 Fly ash

Figure .3 . Fly ash

Fly ash is used for experiment having specific gravity 2.30. Generally fly ash is two type class C and class F. class F fly ash used for experimental work.

3.5 STONE DUST

Figure.4. Stone dust

Stone dust is obtained from Ambikapur, Chhattisgarh having specific gravity of 2.60.

4. EXPERIMENTAL PROGRAME

4.1 CONCRETE MIX DESIGN

For M20 grade of concrete, concrete mix design is prepared as per IS 10262:2009 -

1) Water content = 198 liter /m^3
2) Cement content = 396 kg/m^3
3) Water - cement ratio = 0.5
4) Aggregates:
   - Coarse aggregate fraction= 0.62
   - Fine aggregate fraction= 1- 0.62=0.38

5) Mix Calculation –

a) Volume of concrete = 1m^3
b) Volume of cement = (396/3.15) x (1/1000)
= 0.126 m^3
c) Volume of water = (198/1) x (1/1000)
= 0.198 m^3
d) Volume of aggregates in all -
= 1-0.126-0.198
= 0.68 m^3

e) Coarse aggregate = d) x fraction of coarse aggregate x Specific gravity (G) of coarse aggregate x 1000
= 0.68 x 0.62 x 2.73 x 1000
= 1150.97 kg/m^3

f) Fine aggregate = d) x fraction of fine aggregate x Specific gravity (G) of fine aggregate x 1000
= 0.68 x 0.38 x 2.63 x 1000
= 679.59 kg/m^3

Table.4. Proportions for 1m^3

water	Cement	Fine aggregate	Coarse aggregate
198 liter	396kg	679.59 kg	1150.97 kg

Mix proportion is – 1: 1.71: 2.91
(Cement: fine aggregate: coarse aggregate)

4.2 CASTING

Cubes of size 150mm x 150mm x 150mm is casting for determination of compressive strength. Cement + partially fly ash, sand + partially stone dust, and coarse aggregate are mixed properly with water – cement ratio as obtained in mix design and make a homogeneous mix. After 24 hr of moulding of concrete cubes are cured for 28 days.

4.3 TESTING

Compressive strength of cubes is determined by compression test on compression testing machine of capacity 2000KN. For testing of compressive strength IS 516: 1959 used. According to IS516:1959 load of 140Kg/cm^2/minute applied on the cubes until the cubes are cracks. Strength of concrete is fixed by using criteria of IS 456: 2000.

Figure.5. Compressive strength testing

4. RESULT

Table.5. Result of slump test

Sl. No.	Stone dust content (%)	Fly ash content (%)	Slump (mm)
1	0	0	89
2	15	0	81
3	30	0	73
4	45	0	58
5	60	0	55
6	15	5	93
7	30	10	86
8	45	15	78
9	60	20	70

Table.6. Compressive strength of cubes

Sl. No.	Stone dust content (%)	Fly ash content (%)	Compressive strength after 28 days curing in N/mm^2
1	0	0	22.89
2	15	0	25.11
3	30	0	26.29
4	45	0	21.36
5	60	0	19.55
6	15	5	20.80
7	30	10	24.25
8	45	15	25.32
9	60	20	22.05

5. CONCLUSION

From test result it is clear that the workability of concrete is decreases as the percentage of stone dust is increased but by inclusion of fly ash with stone dust workability increase. By 30% replacement of sand with stone dust concrete gives better compressive strength. When Stone dust and fly ash is used combined it also increases compressive strength of concrete.

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7. BIOGRAPHIES

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