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GRENNER CONCRETE USING AGRO- INDUSTRIAL WASTE AS A PARTIAL REPLACEMENT OF CEMENT

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ABSTRACT

The use of modern and horticultural waste delivered by mechanical procedures has been the focal point of waste decrease look into for financial, natural and specialized reasons. Sugar-stick bagasse is a sinewy waste-result of the sugar refining industry, alongside ethanol fume. This waste item (Sugar-stick Bagasse Ash) is now causing genuine natural contamination, which calls for dire methods for taking care of the waste. Bagasse Ash has for the most part contains silica and aluminum particle. In this undertaking, the Bagasse debris has been artificially and physically portrayed, and incompletely supplanted in the proportion of 0%, 5%, 10%, 15% and 25% by the heaviness of bond in concrete. Normal Portland concrete was supplanted by ground bagasse debris at various rate proportions.

The compressive qualities of various mortars with bagasse debris expansion were likewise explored. M30 concrete blends in with bagasse debris substitutions of 0%, 5%, 10%, 15%, 20% and 25% of the Ordinary Portland bond were set up with water-concrete proportion of 0.42 and concrete substance of 378 kg/m^3 for the control blend. Wet solid tests like droop cone test, just as solidified solid test like compressive quality, split elasticity and flexural quality at the time of 7days, 28 days and 90 days were completed.

The test outcomes showed that up to 10% substitution of bond by bagasse debris brings about better or comparative solid properties and further ecological and financial points of interest can likewise be abused by utilizing bagasse debris as a halfway concrete substitution material.

1. INTRODUCTION: -

Concrete is the world's most expended man-made material. To create 1 ton of Portland bond, 1.5 huge amounts of crude materials are required. These materials incorporate great quality limestone and earth. Thusly, to fabricate 1.5 billion tons of bond every year, in any event 2.3 billion tons of crude materials are required. More than 5- million BTU of vitality is expected to deliver one tone of concrete. In the year 1914, India Cement Company Ltd began bond generation in Porbandar with a yield of 10,000 tons and a creation of 1000 introduced limit. At the hour of autonomy 1947, the introduced limit of concrete plants in India was roughly 4.5 million tons and genuine generation around 3.2 million tons for every year. The incomplete profound control in 1982 provoked different mechanical houses to set an arrangement new concrete plants in the nation, limit was about 30 million tons, which has now, increment to almost 120 million tons during a time of 20 years. The full decontrol on concrete industry in 1988 further gave energy to thedevelopment.

India is the second biggest maker of bond on the globe after China. Altogether, India produces 251.2 Million Tons of bond for each year. The bond business in India has gotten an incredible driving force from various framework ventures taken up by the Government of India like street systems and lodging offices. While the Indian bond industry appreciates an exceptional period of development, specialists uncover that it is balanced towards a profoundly prosperous future over the ongoing years. The yearly interest for concrete in India is reliably developing at 8-10%. National Counsel for Applied Economic Research (NCAER) has evaluated after a broad study that the interest for concrete in the nation is relied upon to increment to 244.82 million tons by 2012. Simultaneously, the interest will be at 311.37 million tones if the projections of the street and lodging fragments are met in all actuality

The creation of predominant nature of Ordinary Portland Cement (OPC) in the nation was principally liable for presenting the reviewing framework in OPC by Bureau of Indian Standard (BIS) during 1986-87. Different assortments of basic bonds, for example, sulfate opposing Portland concrete, Pozzolana concrete and impact heater slag concrete found their way in the improve nature of incited the basic architects and significant buyers to receive higher levels of cements in the development work. This has been checked distinction in the nature of cement during this period principally because of the accessibility of unrivaled nature of bonds in the market. The pattern is proceeding with an ever-increasing number of assortments of bonds are going to the business sectors which help to the shoppers to make appropriated level nature of cement to meet the particular development necessity. The superior fiber strengthened, polymer solid composites and prepared blended cement have been dynamically presented for explicit applications.

2. MATERIALS USED

In this chapter, substances homes and concrete mix layout calculations for M30 grade concrete in element changed into supplied. Mix design summary for M30 under study are protected on this bankruptcy.

2.1 MATERIALS AND THEIR PROPERTIES: -

Raw materials required for the concrete use in the gift work are

- Cement
- Coarse Aggregates
- Bagasse ash
- Fine combination
- Water

Physical properties of cement

S. No	Property	Test results
1	Normal consistency	29%
2	Specific gravity	3.10
3	Initial setting time	92 minutes
4	Final setting time	195 minutes

Physical properties of fine aggregate

S. No	Property	Value
1	Specific gravity	2.67
2	Fineness modulus	3.48
3	Bulk density: A)Loose B) Compacted	 $14kN/m^3$ $15kN/m^3$
4	Grading	Zone-II

Sieve analysis of fine Aggregate

Sieve size	Retained	% retained	Cumulative % retained	%passed
4.75	-----	----	-----	100
2.36	6.5	0.65	6.5	99.3
1.18	80.5	8.7	87	91.3
600	149	23.6	236	76.4
300	733	96.9	969	3.1
150	15	98.4	98.4	1.6
Pan	16	100	1000	0

Fineness Modulus =3.48

Sieve analysis of coarse aggregate

IS Sieve Designation	%Weight Retained In kg	Cumulative Percentage Retained	Cumulative Percentage Passing
80mm	——	—	100
40mm	——	—	100
20mm	30.84	30.84	69.16
10mm	68.70	99.54	0.46
4.75mm	0	99.54	0
2.36mm	0	99.54	0
1.18mm	—	100	0
600 Mic	—	100	0
300 Mic	—	100	0
150 Mic	—	100	0

$$\text{FinenessModulus} = \frac{\text{Cumulative \% retained}}{100}$$

Fineness Modulus = 3.02

Physical properties of coarse aggregate

S. No	Property	Value
1	Specific gravity	2.88
2	Fineness modulus	3.02
3	Bulk density Loose Compacted	14kN/m^3 16kN/m^3
4	Nominal maximum size	20 mm

Physical properties of water

S. No	Property	Value
1	Ph	7.1
2	Taste	Agreeable
3	Appearance	Clear
4	Turbidity (NT units)	1.75

Physical Properties of Bagasse Ash

Properties	Values
Specific Gravity	2.20
Colour	Black
Density (gm/cm3)	1.20
Moisture content	6.28%

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Chemical composition of Bagasse Ash

Components	Mass %
Silica as SiO2	70.5
Calcium as CaO	4.7
Potassium ask2O	12.16
Iron as Fe2O3	1.89
Sodium as Na2O	3.82
Aluminum as Al2O3	1.36
Magnesium as MgO	4.68
Titanium as TiO2	< 0.06

3. CONCRETE MIX DESIGN

3.1 DESIGN OF M30 GRADE CONCRETE: STIPULATIONS FORPROPORTIONING:

a) Grade of Concrete :M30
b) Type of cement : OPC 53grade confirming IS:12269
c) Minimum Cement content :300kg/m³
d) Maximumnominalsize of aggregate :20mm
e) Maximumwater– cement ratio :0.5
f) Workability : 100mm(slump)
g) Exposure condition :Moderate
h) Methodof concreteplacing :Non - Pumpable
i) Degree of supervision :Good
j) Type ofaggregate : Crushed angularaggregate

3.1.1 TEST DATA FOR MATERIALS:

a) Cement used : OPC 53 gradeconfirming IS:12269
b) Specificgravity of cement :3.10
c) Mineral admixture : -----------
d) Specific gravity of
   i. Coarse aggregate :2.88
   ii. Fine aggregate :2.67
   iii. Bagasse Ash :2.20
e) Waterabsorption
   i. Coarse aggregate :0.5%s
   ii. Fine aggregate :1.0%
f) Free (Surface)moisture
   i. Coarse aggregate :NIL
   ii. Fine aggregate :NIL
g) Sieve analysis
   i. Fine aggregate : Confirming to grading Zone II of Table

3.2 TARGET STRENGTH FOR MIX PROPORTIONING:

$f'ck$ = $f\,ck$+1.65S
= 30+1.65 × 4
= 36.60 N/mm²

Where

f'ck	=	target average compressive strength at28days
$f$ck	=	characteristic compressivestrength at 28days
S	=	standard deviation from Table 1of IS10269:2009,
Standarddeviation(s)	=	4N/mm²
Targetstrength	=	36.60N/mm²

3.3 SELECTION OF WATER-CEMENT RATIO:

From Table 5 of IS 456,maximumwater cement ratio = 0.45 Based onexperience,

Adopt w/c = 0.42
0.42< 0.45 hence O.K

3.3.1.1 SELECTION OF WATER CONTENT:

From Table 2 of IS10262:2009maximum water = 186 liters

(For 25 to 50 mm Slump range) for20 mm aggregate

Estimated water content for100 mmslump

$$= 150 + \frac{6}{(100 \text{ X } 150)}$$

= 159 liter

3.3.1.2 CALCULATION OF CEMENT CONTENT:

Water-cement ratio = 0.42

Cement content $= \frac{159}{0.42}$

= 378.57 kg/m³

From Table 5 of IS 456 minimum cement content

For 'Moderate exposure condition = 300 kg/m³

378.57kg/m³> 300 kg/m³, hence, O.K

3.3.2 PROPORTION OF VOLUME OF COARSE AGGREGATE AND FINE AGGREGATE CONTENT:

From Table 3 of IS: 10262-2009

Volume of coarse aggregate corresponding to 20mm size aggregate & fine aggregate (Zone 2) For water-cement ratioof0.50.

But our water content is 0.42.

Therefore, water cement ratio lovers by 0.08, the proportion of Volume of coarse aggregate is increased by 0.02 (@ of -/+ 0.01 for every0.05 change in w/c ratio)

A) Volume of Coarse aggregate for thewater– cement ratio 0.42 = 0.64

B) Volume of fine aggregate = 1- 0.64
= 0.36
= 0.122 m3

C) Volume of admixture = Nil

D) Volume ofall in aggregate = [a – (b + c+d)]

= 1-(0.122+0.159)

= 0.719m3

E) Massof coarse aggregate = e ×Volume of CA × Specific gravity of CAx1000

= 0.719 × 0.64 × 2.88 × 1000

= 1325 kg

F) Massof fine aggregate = e × Volume of FA× Specific gravity of FA×1000

= 0.719 × 0.36 × 2.67 × 1000

= 691 kg

3.4 MIX PROPORTIONS FOR TRAIL:

Cement = 378kg/m³
Water = 159litre
Fine aggregate: = 691kg
Coarse aggregate = 1325kg
Water Cementratio = 0.42

4.0 EXPERIMENTAL WORK

In this bankruptcy, ideas of experimental paintings are presented. Objective of checking out, i.e. Ordinary Portland cement, pleasant mixture, coarse mixture, potable water and bagasse ash process of manufacturing of concrete, workability of fresh concrete and testing of hardened concrete tactics are explained in information.

No. of specimens prepared for determining hardened properties.

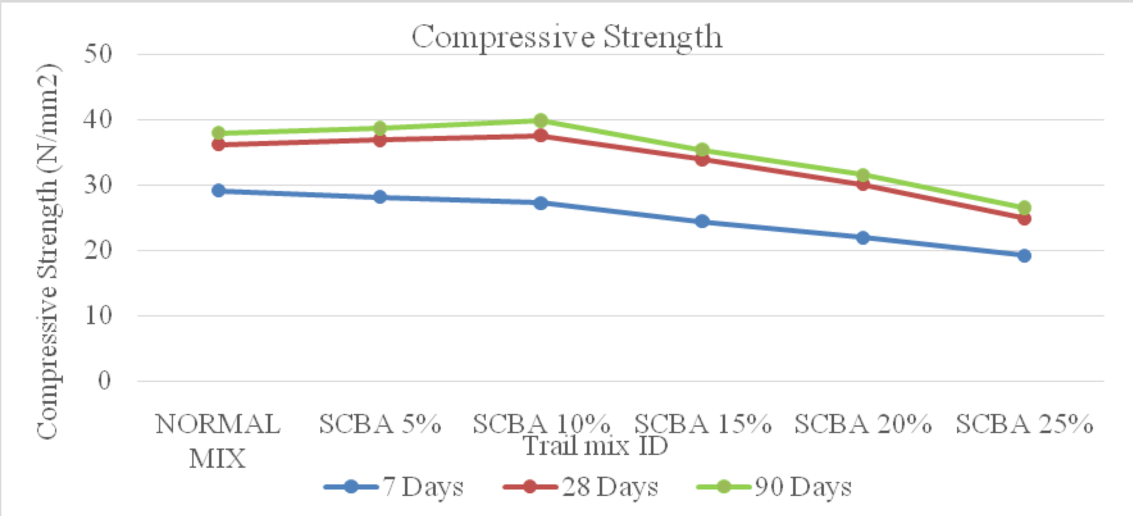
Specimens	No. of specimen cured in water					
	NORMAL MIX	SCBA 5%	SCBA 10%	SCBA 15%	SCBA 20%	SCBA 25%
Cubes	9	9	9	9	9	9
Cylinders	9	9	9	9	9	9
Beams	9	9	9	9	9	9

5.0 TEST RESULTS

5.1 COMPRESSIVE STRENGTH RESULTS:

Compressive strength test results

S. No	Mix id	Compressive Strength (N/mm^2)		
		7 Days	28 Days	90 Days
1	NORMAL MIX	29.13	36.18	37.93
2	SCBA 5%	28.15	36.89	38.67
3	SCBA 10%	27.26	37.52	39.85
4	SCBA 15%	24.44	33.93	35.41
5	SCBA 20%	21.93	30.07	31.56
6	SCBA 25%	19.26	24.85	26.52

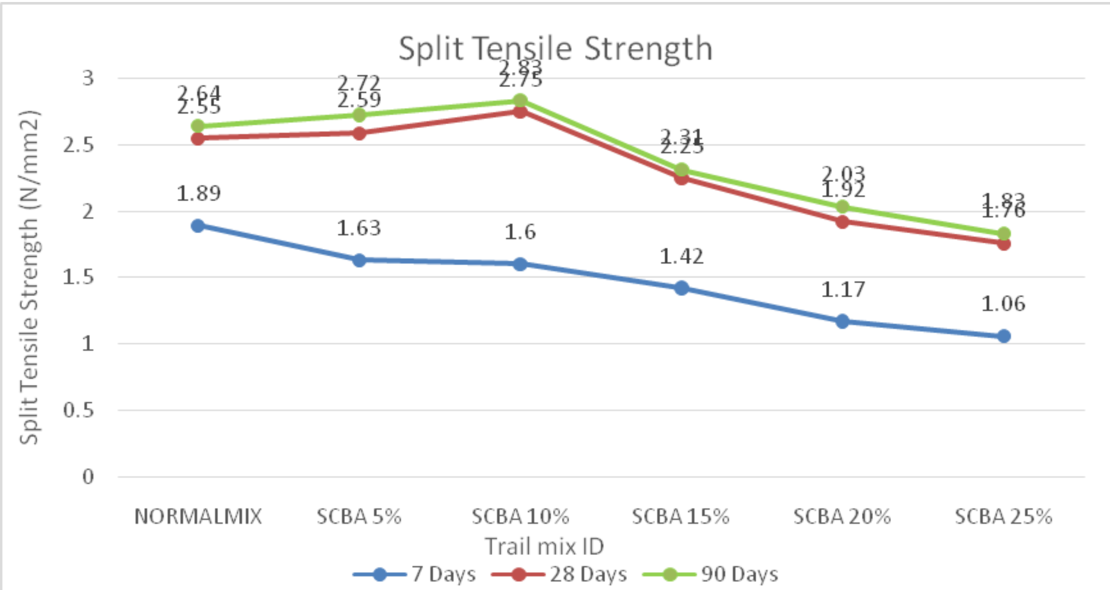


Compressive Strength (N/mm2)

5.2 SPLIT TENSILE STRENGTH RESULTS:

S.No	Mix id	Split Tensile Strength (N/mm^2)		
		7 Days	**28 Days**	**90 Days**
1	NORMALMIX	1.89	2.55	2.64
2	SCBA 5%	1.63	2.59	2.72
3	SCBA 10%	1.60	2.75	2.83
4	SCBA 15%	1.42	2.25	2.31
5	SCBA 20%	1.17	1.92	2.03
6	SCBA 25%	1.06	1.76	1.83

Split tensile strength test results



Split Tensile Strength graph vs age

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5.3 FLEXURAL STRENGTHRESULTS:

Flexural strength test results

S.No	Mix id	Flexural Strength (N/mm^2)		
		7 Days	28 Days	90 Days
1	NORMALMIX	4.67	5.87	6.25
2	SCBA 5%	4.53	6.13	6.52
3	SCBA 10%	4.53	6.43	6.92
4	SCBA 15%	3.33	5.75	5.85
5	SCBA 20%	3.20	4.93	5.22
6	SCBA 25%	3.07	4.13	4.66

6. CONCLUSIONS

Based on the study of the above thesis, following conclusions noted.

- There is a change in slump for SCBA 5% has decreased 3.49% whencompared withnormalmix.
- TheslumpforSCBA10%,SCBA15%,SCBA20%andSCBA25%hasreducedby4.65%, 8.14%,13.95%and 18.60% respectively when compared with the normalmix.
- The compaction factor value is gradually decreased. It was observed that the Mixes are SCBA 5%, SCBA 10%, SCBA 15%, SCBA20% and SCBA 25% has reduced by 2.43%, 5.86%, 9.68%, 12.84% and 16.29% respectively when compared with the Normal Concrete Mix.
- The compressive strengths of SCBA mixes at the age of 7 days was gradually decreases its strength when compared withnormalmix.
- It was observed that the compressive strength of SCBA 5% and SCBA 10% at the age of 28 days has reached its target mean strength; however, the compressive strength was increased by 1.96% and 3.70% when compared with normalmix.
- It was observed that the compressive strength of SCBA 15%, SCBA 20% and SCBA 25% at the age of 28 days has decreases its compressive strength by 6.22%, 16.89% and 31.32% respectively when compared with the normal mix.
- The compressive strength of SCBA 5% and SCBA10% at the age of 90 days has increased 1.95%, and 5.06%respectively compared to the normal mix. The other mixes of SCBA 15%, SCBA 20% and SCBA 25% has decreased 6.64%, 16.79%, and 30.08% respectively compared to the normal mix.
- The split tensile strength of mixes SCBA 5% and SCBA 10% at the age of 28 days has increases its strengths by 1.57% and 7.84% respectively when compared with the normal mix. It is observed that the split tensile strength of SCBA 5% and SCBA 10% at the age of 90days is also increased as 3.03% and 7.20& respectively.
- The split tensile strength of mix SCBA 15%, SCBA 20%, SCBA 25% at the age of 28 days has decreases it strengths by 11.76%, 24.71% and 30.98% when compared with the normal

mix. The Split tensile strength of above mixes are decreased at the age of 90days by 12.5%, 23.11%, and 30.68% respectively.

- The flexural strength of SCBA 5%, SCBA 10% at the age of 28 days has increases its strength by 4.24%, and 9.14% when compared with the normalmix and the mixes observed at the age of 90days are 4.14%, 10.28 % increased.
- The flexural strength is of SCBA 15%, SCBA 20% and SCBA 25% are observed at the age of 28 days as decreased 1.96%, 15.33% and 28.38% respectively compared with normal mix and further observation is made at the age of 90 days also decreased as 6.13%, 15.80% and 24.39% respectively compared with normal mix.
- Finally observed the cement can be replaced with Sugarcane bagasse ash up to 10% without any loss in Workability, Compressive strength, Split Tensile Strength and Flexural Strength.
- Considerable decrease in compressive strength was observed from 15% cement replacement. It has been shown in this study that 10% sugarcane bagasse ash can be used as a partial cement replacement material with technical and environmental benefits.
- Concerned stakeholder, such as sugar industries, cement industries and relevant government institutions, should be made aware about this potential cement replacement material andpromote.

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