International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 1, December 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

To Study the Characterstic Behaviour of Concrete using Glass Waste and Steel Waste

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ABSTRACT

The most important and a essential necessity for modern society is a well maintained infrastructure which provides greater value and also ensures that it meets all the basic requirements is challenging. Concrete as a construction material is in use for several decades. Concrete can withstand the severest environments and engineers are constantly trying to enhance the performance with the aid of modern admixtures as well as waste materials which may or may not have the cementious properties. If the waste material is used in concrete, it will help in consumption of waste material along with the enhancement in the properties of concrete in new as well as hydrated states. Civil structures are designed considering the goal compressive 1strength of the concrete. Although, rare other parameters such as workability, water to 1cement ratio, setting time of cement along with surface hardness influence the performance of concrete.

Series of experiments had been performed in this current study for a comparison of the usage of Glass Waste and Steel Waste as a replacement of sand in various different proportions. In this Study, Blended cement which was a mixture of Portland cement with Fly ash in 1:0.5 and 1:1 proportion was used. Concrete mixes are modified by 10%, 15%, 20% and 25% of Glass Waste and Steel Waste in replacement. The main conclusions drawn was that the compressive strength increases with the inclusion of Glass Waste upto a certain proportions and then reduces the strength. Steel Waste increases the strength but reduces the workability. Comparative1y higher ear1y strength gain (3- days) is obtained with stee1 Waste concrete.

How to cite this paper: Amandeep | Ashish Verma "To Study the Characterstic Behaviour of Concrete using Glass Waste and Steel Waste" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-1, December 2019, pp.231-236, URL: https://www.ijtsrd.com/papers/ijtsrd29513.pdf

IJTSRD29513

INRODUCTION

Concrete is a combination of cement, water, coarse aggregate and sand. The success of it is in the flexibility of Its as could be designed to resist harshest environments while taking on probably the most inspiring types. Engineers are attempting to boost the limits of its by using ideal admixtures as well as different waste materials.

Utilization of Glass Waste , Steel Waste or other desecrate materials in preparing concrete for many civil engineering projects is a subject of high significance. Integration of added materials in concrete or mortar affects its several characteristics such as strength, workability and other re1ative presentations

There are various purposes of applying additional materials as substitute to cement and other components in concrete – First is the financial saving obtained by replacing a considerab1e part of the sand or other ingredients with these materials and second is enhancement in the properties of concrete

The ecological aspects of cement are now receiving more concern of researchers, as cement Emergent is liable for about large amount of total worldwide waste emissions from manufacturing sources. The trend of mixing several kinds of additional materials in structure engineering is now growing. This has double advantage -

ADDITIVE USED IN THE PRESENT STUDY

Sand is the main material needed for fulfilling the Modern Infrastructure Needs. As an outcome, the construction and concrete industry across the globe is facing many obstacles in material conversation along with Natura1 resources. As per International Energy Agency, the most important focus for material producers to enhance the energy Efficiency a1ong with the usage of substitute wastes or other waste materials. Consequently, it is converting into employ the substitute material in cement concrete.

Glass Waste is a significant material utilized in the structure production. In past 10 years, significant attention has already been given to the usage of Glass Waste as a restricted replacement of sand to produce concrete with high-strength. Glass Waste is added to enhance the basic properties of concrete, in particular its compressive strength, and other resistance. Glass Waste contains fine partic1es with size similar to the size of average sand partic1e size.

OBJECTIVE OF PRESENT WORK

A series of experiments had been performed, in the current work

1. To compare and determine properties in particular the mechanical properties of concrete mixes which was prepared by ordinary Portland cement.
2. To define the impact on the properties of concrete mixes which are modified by adding 10%, 15% and 20% and

25% of Glass Waste as well as Steel Waste as partial replacement of sand.
3. To study the variation of properties when ingredients are mixed in M 30 proportions. Different properties studied are 7 days, 14 days and 28 days compressive strengths, workability and setting time.

LITERATURE REVIEW

Toutanji and El-Korchi [2018] carried out experimental work on Oxygen and watervapor transport in cement pastes, hence concluded that the increase in compressive strength of mortar containing glass Waste as a partial replacement for cement, greatly contributes to strengthening the bond between the cement paste and aggregate. It wasalso demonstrated that super plasticizer in combination with glass Waste plays a more effective role in mortar mixes than in paste mixes.

Maslehuddin et al. [2013] carried out research based experimental work on the comparability of qualities of metal slag and crushed limestone aggregate concretes, finally concluded that durability qualities of steel slag cement concrete had been better than people of crushed limestone aggregate concrete. Several of actual physical attributes had been a lot better than of crushed lime stones concrete.

Wu et al. [2017] carried out Research work of Utilization of metal slag as aggregates for stone mastic asphalt (SMA) mixtures. Outcomes of the evaluation showed that are exceptional after 2 years system, with abrasion as well as friction coefficient of 55 BPN and area consistency level of 0.8 mm.

Gonen and Yazicioglu [2016] carried out research work and concluded that the Glass Waste contributed to both short and long term properties of concrete, where as fly ash shows its advantageous effect in a relatively more time. As far as the compressive strength is concerned, adding of both glass Waste and fly ash merely increased compressive strength, but contributed more to the improvement of transport properties of concrete.

Akbulut and Gürer [2017], Asphalt pavements are mainly composed of aggregates. Large amount of aggregates have been utilized by industries involved in highway construction. Several tests over aggregates have been conducted such as Los Angeles abrasion tests. It has been revealed from the experimental results that the physical properties determined of the aggregates are within particular range.

Westerholm et al. [2018] presented the results obtained by performing a laboratory investigation over the rheological properties, like yield stress and viscosity of the concrete. The consequence of grading and particle shape of the sand has been investigated using proper equipments. The results of experiments illustrate that the quantity and characteristics of sand influenced the properties of mortar such as consistency and workability. The influence of the sand properties significantly depends over the quantity of mortar. Decreases compressive strength with replacement of cement with Glass Waste of concrete up to 16%.

Qasrawi et al. [2019] carried out research work in use of low CaO unprocessed steel slag in concrete as fine aggregate. Their conclusion is that the compressive and tensile strength of concrete steel slag is more beneficial for concretes of lesser strengths.

Boukendakdji et al. [2013] carried out Research job of Effect of slag on the rheology of new self-compressed concrete. They inferred that the slag is able to make very good self-compacting concrete.

Bernal et al. [2014] carried out Research job of Performance of an alkali activated slag concrete reinforced with metal fibers. They concluded that the developed concrete presents higher compressive strengths than the OPC reference concretes.

Zega [2010] several ecological issues initiated by waste produces form big constructions and their waste obtained by demolition. The deficiency of enough deposition space and the lack of natural objects cause the use of waste aggregates in the production of new concrete.

EXPERIMENTAL WORK

COMPRESSION TEST ON CONCRETE AFTER REPLACEMENT

Experiments have been performed for evaluating compressive strength of concrete blocks prepared by Replacing sand with Glass Waste and Steel Waste in different percentage. Several concrete cubes have been prepared by replacing 10 % , 15 % , 20 % and 25 %, sand by weight with these waste materials. For preparing Mix the cement, sand and aggregate have been batched as 1:1.5:3 proportions for forming M-20 mix. Cube moulds of 15 X 15 X 15 cm have been used for Casting cubes. The weight of constitutes and waste materials obtained by concrete mix design, for each percentage of replacement has been presented in

Weight of ingredients in each percentage

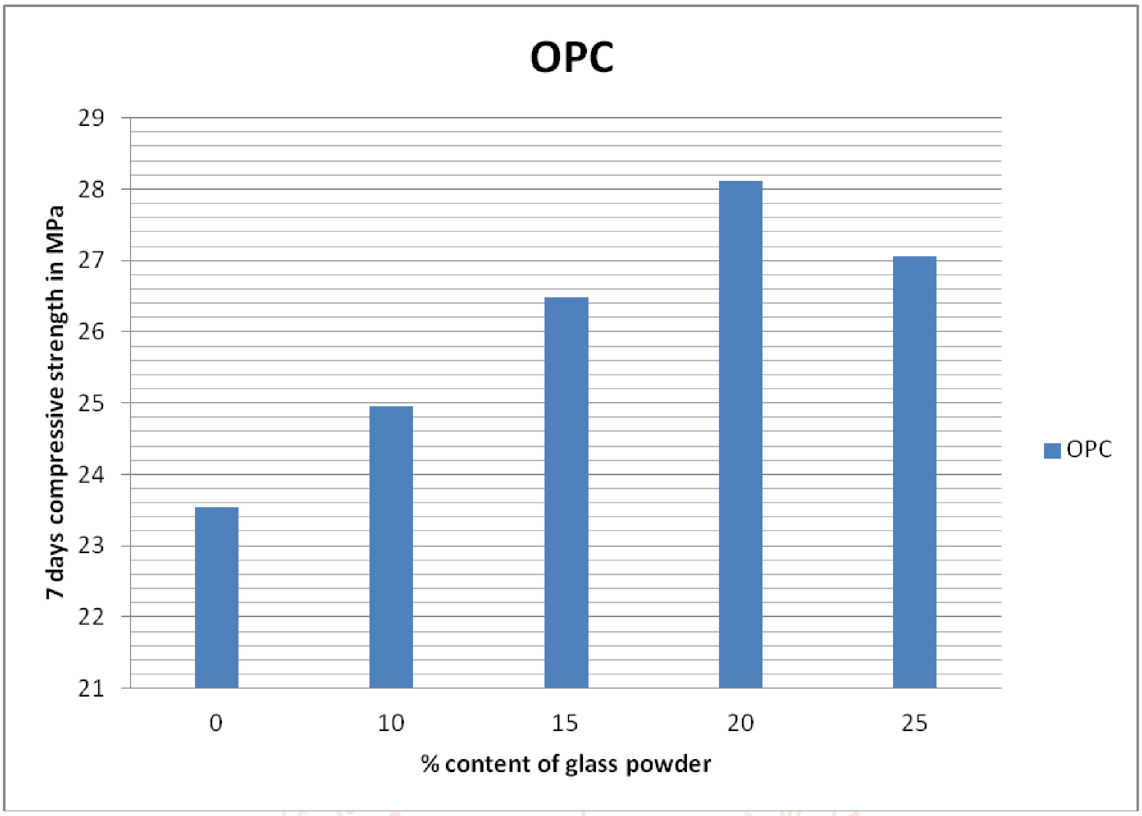
% of sand replaced	Weight (kg)			
	Cement	Sand	Aggregate	supplementary Material as replacement of sand
0	7	9.44	22	0
10	7	10.51	22	1.24
15	7	8.40	22	1.567
20	7	8.931	22	2.13
25	7	7.862	22	2.674

Replacement by Glass Waste

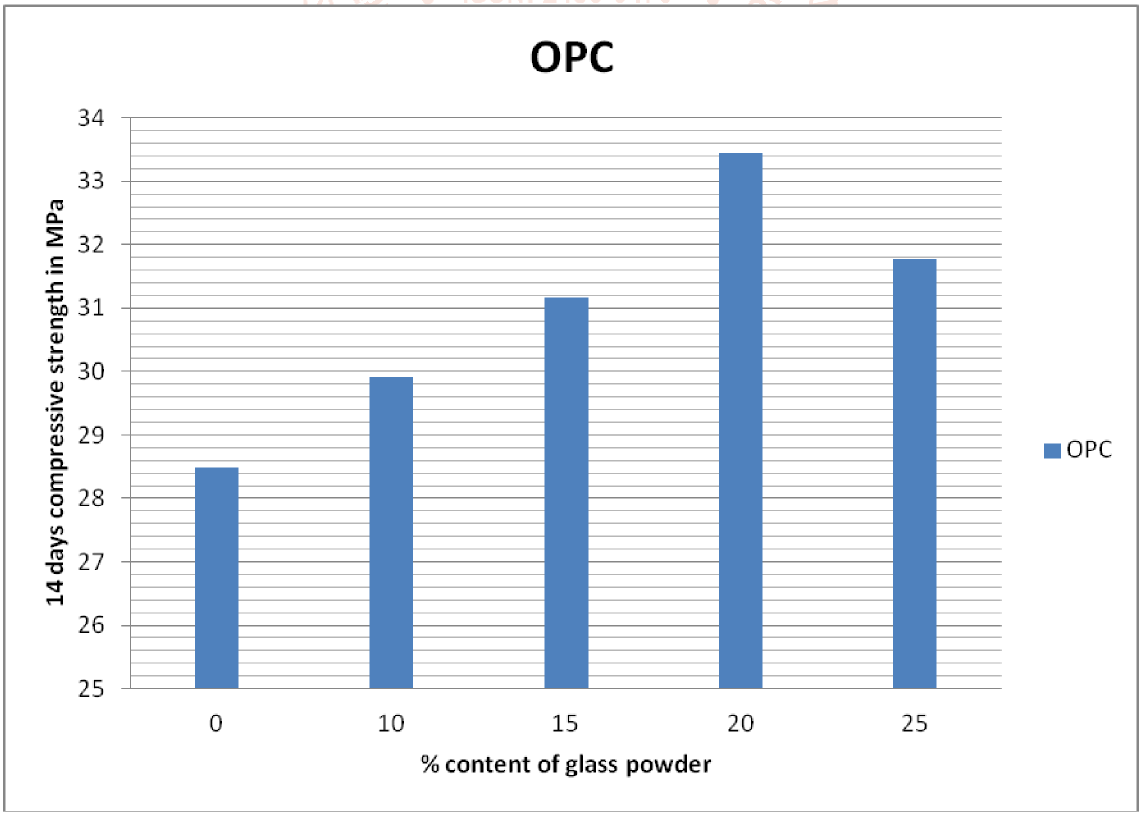
By replacing sand with Glass Waste in different percentages following results have been obtained

Results of compressive test

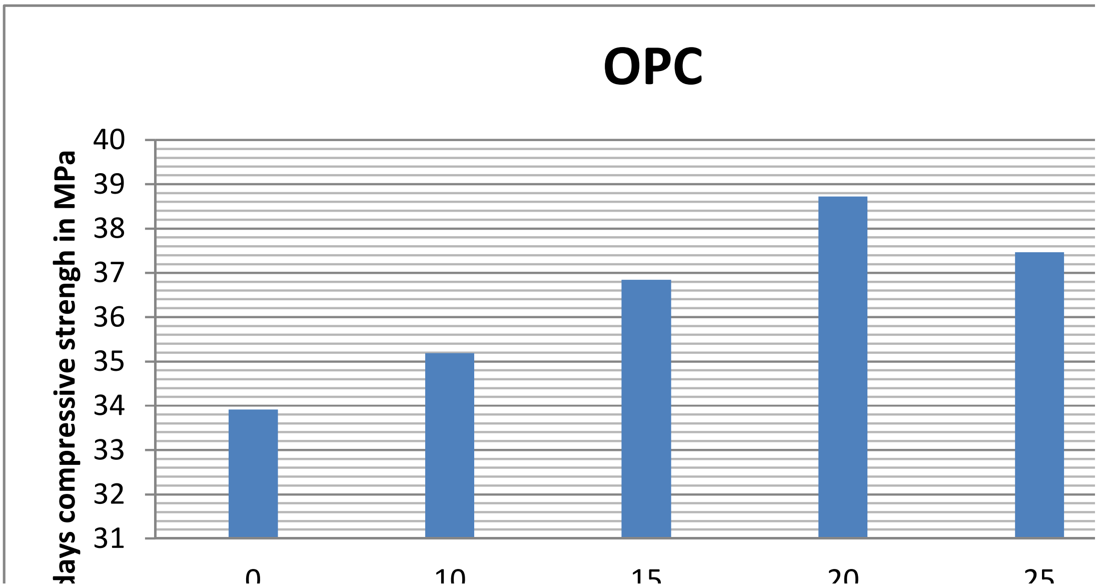
Type of cement	% of sand replaced by Glass Waste	7 days	14 days	28 days
OPC	0	21.29	26.35	32.45
	10	22.33	28.57	34.84
	15	23.32	30.86	34.94
	20	24.62	32.22	36.66
	25	23.33	30.28	33.84



Compressive strength after 7 days



Compressive strength after 14 days



Compressive strength after 28 days

Replacement by steel Waste

By replacing sand with Steel Waste in different percentages following results have been obtained:-

Results of compressive test

Type of cement	% of sand replaced by steel Waste	7 days	14 days	28 days
OPC	0	23.25	28.22	33.63
	10	26.69	30.64	34.83
	15	27.35	**31.85**	35.46
	20	**27.76**	31.63	**35.75**
	25	26.74	30.79	34.46

SLUMP CONE TEST FOR WORKABILITY AFTER REPLACEMENT

Replacement of sand with Glass Waste

Along with compressive strength workability of concrete is major parameter required for testing the quality of concrete mix, again by mixing Glass Waste in cement concrete in different proportions such as in 10%, 15%, 20% and 25% following results were obtained.

It has been observed from below given table that slump value reduces with the increase in values of percentage replacement following changes are presented in following figures. However, It has been observed that workability of concrete increases with use of steel Waste.

Table – Results of workability test

Mix	% Replacement	Slump Value
OPC	0	92
	10	86
	15	83
	20	81
	25	77

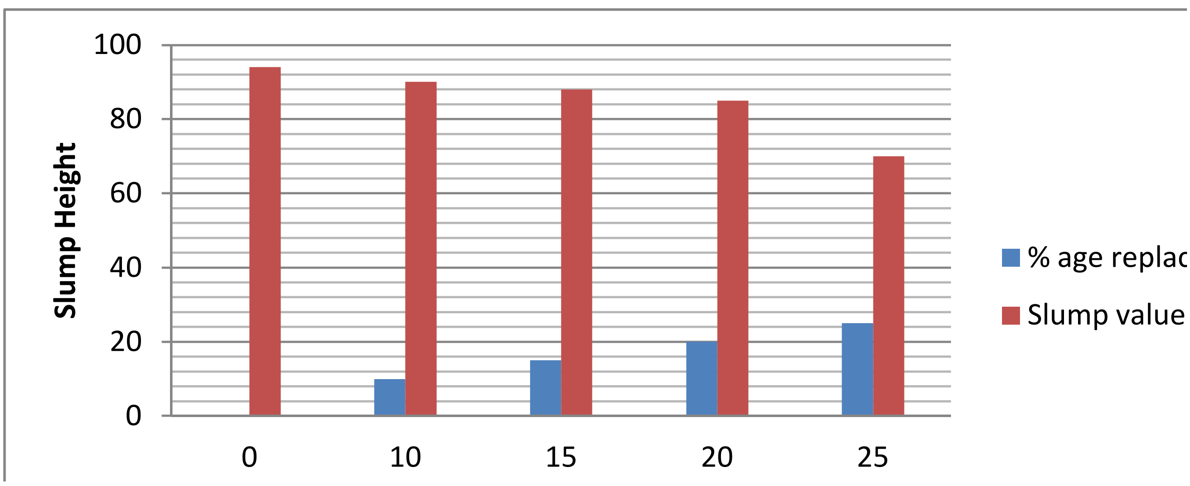


Fig. Slump height for OPC

Replacement of sand with steel Waste

Along with compressive strength workability of concrete is major parameter required for testing the quality of concrete mix, again by mixing Glass Waste in cement concrete in different proportions such as in 10, 15, 20 and 25% following results were obtained.

Mix	% Replacement	Slump Value
OPC	0	92
	10	90
	15	87
	20	84
	25	79

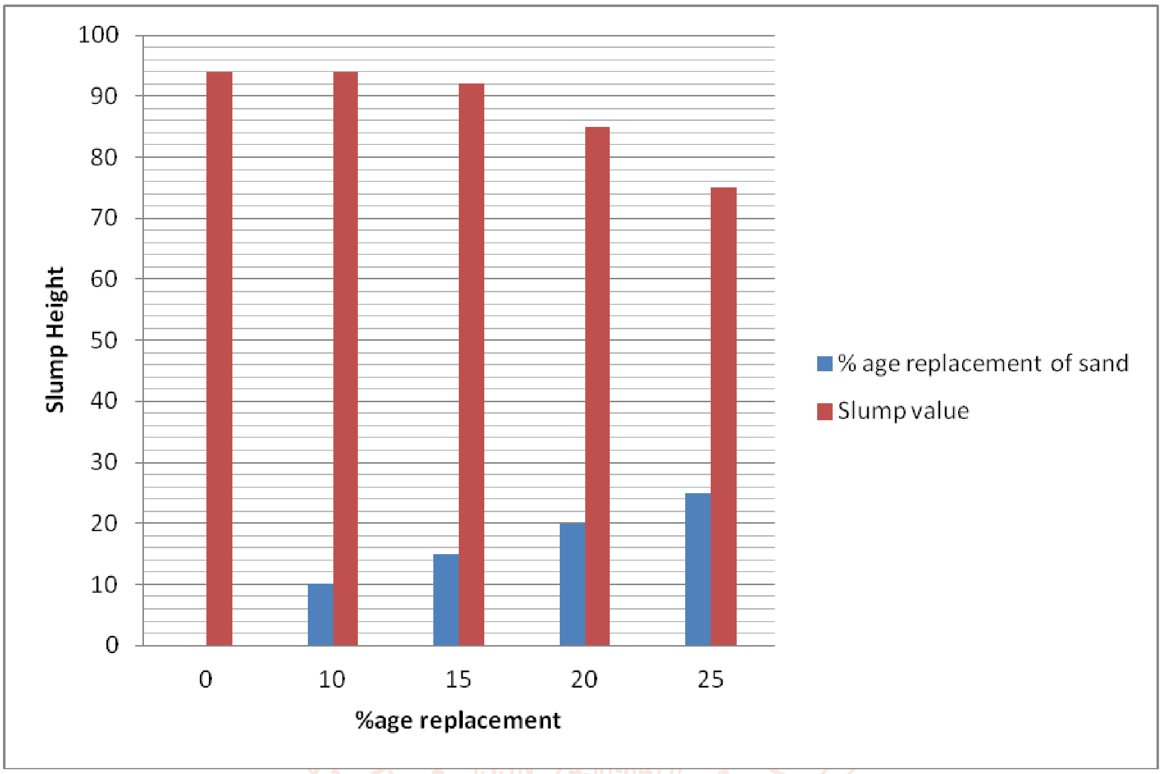


Fig. Slump height for OPC

FLEXURAL STRENGTH

General

The most common concrete structure subjected to flexure is a highway or Airway pavement and strength of concrete for pavements is commonly evaluated by means of bending tests. When concrete is subjected to bending, then tensile and compressive stresses and in many cases direct shear stresses are developed.

Flexural Strength (F.S.)

Sample	Avg Load (KN)	F.S. (MPa)	F.S.(kg/cm^2)
Controlled (FR00)	35.3475	6.284	62.84
Glass Waste 10%	34.0575	6.055	60.55
Glass Waste 15%	32.0775	5.703	57.03
Glass Waste 20%	29.67	5.275	52.75
Glass Waste 25%	26.34	4.687	49.34
Steel Waste 10%	26.467	4.456	49.56
Steel Waste 15%	21.678	3.654	39.57
Steel Waste 20%	19.124	3.987	34.64
Steel Waste 25%	21.324	4.211	40.23

CONCLUSION AND FUTURE SCOPE

The main conclusions drawn are:

1. Experiments have been done in order to examine Steel Waste and Glass Waste as replacement of sand in concrete.
2. Various Concrete mixes were prepared by replacing sand with these materials for determining compressive strength and slump values.
3. It has been observed that the slump value or workability decreases with the increase in content of supplementary materials.
4. The compressive strength increases up to a certain proportions with inclusion of Glass Waste
5. Steel Waste increases the strength but reduces the workability.
6. Comparatively higher early strength gain (7-days) is obtained with Steel Waste concrete.

SCOPE FOR FUTURE WORK

For determining the suitability and usefulness of waste materials in civil works, as a replacement to principal materials more experimental data in terms of properties and their variation are required.

Several other materials are required to test as supplementary materials for different sets of properties. Effect over few significant properties such setting time, water-cement ratio, resistivity to external attack are required to get evaluated.

It has been vital to observe changes in characteristics of concrete for judging the suitable materials among the tested materials as a good replacement of cement.

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