# EXPERIMENTAL INVESTIGATION ON REPLACEMENT OF MAGNETIC WATER AND PARTIAL REPLACEMENT OF STEEL SLAG BY COARSE AGGREGATE IN CONCRETE

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**ABSTRACT:** *Concrete is the most broadly used man-made building material on planet . When cement & water are mixed with sand resulting product is called concrete . Instead of water and coarse aggregate we used magnetic water and steel slag (SS). It gives better strength compare to the conventional concrete . Normally Use of magnetic water(MW) if increased the percentage of compressive strength. The percentage of steel slag is,50% , 60% 70% can be replaced . Due to addition of steel slag it obtain good result.*

***KEY WORDS*: Magnetic water (MW), steel slag (SS), coarse aggregate, compressive strength.**

## 1.INTRODUCTION:

The word concrete originates from the word "concretes", which means to grow together. Concrete plays a critical role in the design and construction of the society infrastructure. Natural aggregates are usually obtained from natural rocks. They are inert filler materials and depending upon their size they can be seperated into coarse aggregates and fine aggregates. The unit cost of coarse aggregate increase day by day, therefore the use of alternative sources for natural aggregates is becoming increasingly important. slag is a by- product of the iron and steel making process. Its cost is low comparing to natural aggregates. Thus ,this experimental study an attempt is made to use of steel slag , a By-product from steel industry as replacement for coarse aggregate in concrete. It will be cost effective and also a better way for managing its disposal. Magnetic water is an cost high compared to the normal water .Its improve strength and workability slightly more than that of ordinary water concrete.

## 2. OBJECTIVE OF THE PRESENT STUDY:

1. To study the broader use of the magnetic water for mixing the concrete.

2. To study the possibility of using steel slag as coarse aggregate replacement in concrete.

3. To study the feasibility of utilization of steel slag as coarse aggregate replacement material.

a) Compressive strength

b) Split Tensile strength

c) Flexural strength

4. To investigate the strength of replaced concrete with that of conventional concrete.

## 3. MATERIAL PROPERTIES:

3.1 MAGNETIC WATER

3.2 STEEL SLAG

### 3.1. MAGNETIC WATER:

The Magnetic In this research study, magnetic water is prepared by retaining water in a glass beaker over a circular magnet of 985 Gauss which is obtained from scientific store. The Magnetic water is obtained by placing the beaker filled with

water over the magnets for a period of 24 hours During this time magnetic field penetrates through the glass into the water, which absorbs the magnetic water is are used for making concrete .

**Fig(1). Magnetic water**

### 3.2.STEEL SLAG :

Steel making slag is defined as the solid material. Slag is generated as a by product of iron and steel manufacturing process. Slag is mixture of metal oxides and silicon dioxide. Describe slag that originates from molten waste material when trash and other substances are disposed of at an incinerator facility.

### 3.2.1. Chemical Composition Of Steel Slag:

| **Constituent Composition** | **%** |
|---|---|
| CaO | Nil |
| SiO2 | 11 |
| FeO | 76 |
| MnO | 5 |
| MgO | Nil |
| Al2O3 | 1 |
| P2O5 | Nil |

### 3.2.2. Physical Composition Of Steel Slag:

| **Properties** | **%** |
|---|---|
| Water absorption | 1.9 |
| Crushing strength | 29.3 |
| Impact value | 29 |
| Los Angeles Abrasion | 28 |

### 3.3.FINE AGGREATE:

Sand was collected from nearby river Zone-III is used as a fine aggregate is passed through the sieve of 4.75mm. IS: 383(1970) is followed for fine aggregate.

### 3.4. COARSE AGGREGATE:

Crushed coarse aggregates with nominal sizes of 12mm and 20mm maximum size obtained from the local crushing plants Fine aggregate (sand) is sourced from a local supplier, the coarse and fine aggregates had a specific gravity of 2.15 respectively.

### 3.5.CEMENT:

For the present investigation 53-Grade ordinary Portland cement with specific gravity of 3.15 and 28days compressive strength of 54.7 N/mm2 .

### 3.6WATER:

Water cement ratio (W/C) of 0.45 was used in the preparing of concrete and for this purpose portable water used for mixing and curing purpose.

## 4.EXPERIMENTAL METHODOLOGY:

In the present investigation work on M25 grade of concrete mix trials were done on procured material. The Indian standard mix design procedure is adopted (i.e., IS: 10262-2009) to arrive the mix proportions for M 25 grade of concrete. The concrete mixture where prepared with percentage 50% , 60% , 70% of partial replacement of steel slag by coarse aggregate in concrete the water cement ratio of using for magnetic water .The concrete specimens prepared. The prepared concrete mixture is casted in cubes ,cylinder and beams by using hand held vibrator. 24 hours mould will be removed then cured by using portable water in 28 days.

## 5. CURING OF CONCRETE:

Casting of concrete after the completion of 24 hours mould will be removed then cured by using portable water. The specimen is fully immersed in portable water for specific age of 7, 14, 28 days. After the completion of curing it will be tested.

## 6. RESULT AND DISCUSSION:

### 6. 1. THE COMPRESSIVE STRENGTH

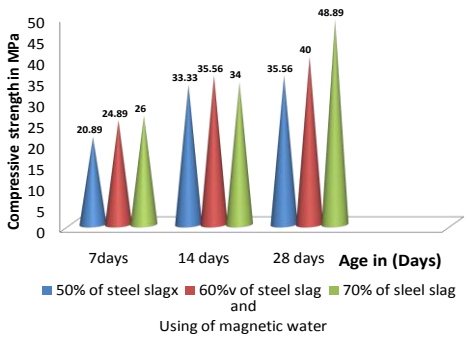
The compressive strength is determined by dividing the maximum of failure load of the specimen during the test by the cross sectional area of the specimen. The normal concrete and the percentage of replacements in special concrete are crushed at different days (7, 14, 28 days) are show in table & graph details.

$$\text{Compressive strength} = \frac{P}{A} (\text{N/mm}^2)$$

**TABLE1. COMPRESSIVE STRENGTH TEST**

| *S.NO* | *MIX* | *Avg. compressive strength(mpa)* | | |
|---|---|---|---|---|
| | | *7 Days* | *14 Days* | *28Days* |
| 1 | NC | 16.70 | 22.6 | 25.75 |
| 2 | 50% | 20.89 | 33.33 | 35.56 |
| 3 | 60% | 24.89 | 34.56 | 40 |
| 4 | 70% | 26 | 34 | 48.89 |

**CHART (1) COMPRESSIVE STRENGTH**




### 5.2.SPLIT TENSILE STRENGTH

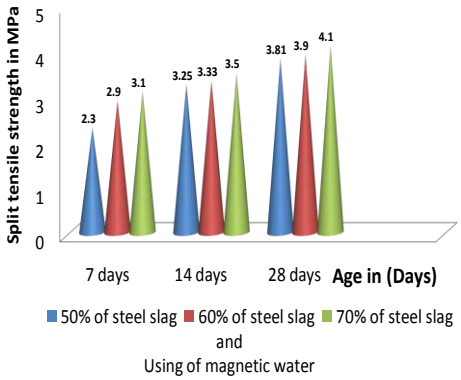
A measure of the ability to resist a force that tends to pull it part. It is expressed as the minimum tensile stress needed to split the material apart.

$$\text{Split tensile strength} = \frac{2P}{\pi DL} (\text{N/mm}^2)$$

**TABLE :2. SPLIT TENSILE STRENGTH**

| *S.NO* | *MIX* | *Avg. split tensile strength(mpa)* | | |
|---|---|---|---|---|
| | | *7 Days* | *14Days* | *28Days* |
| *1* | NC | *2.3* | *2.8* | *3.0* |
| *2* | 50% | *2.8* | *3.25* | *3.81* |
| *3* | 60% | *2.9* | *3.3* | *3.9* |
| *4* | 70% | *3.1* | *3.5* | *4.1* |

**CHART (2) SPLIT TENSILE STRENGTH**




### 5.3.FLEXURAL STRENGTH

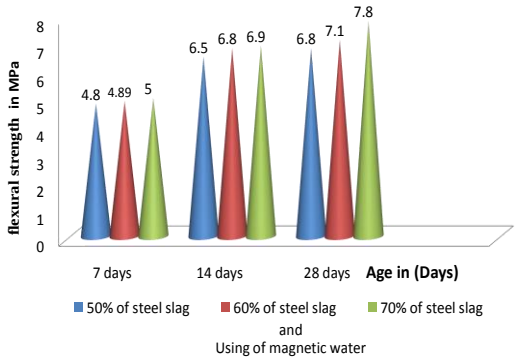
The flexural strength is stress at failure in bending. Flexural strength ,also known as modulus of rupture, or bend strength, or transverse rupture is a materials property , defined as the stress in material just before it yields flexural test.

$$\text{Flexural strength} = \frac{3Pa}{bd^2} (\text{N/mm}^2)$$

**TABLE: 3. FLEXURAL STRENGTH**

| *S.NO* | *MIX* | *Avg. flexural strength(mpa)* | | |
|---|---|---|---|---|
| | | *7 Days* | *14Days* | *28Days* |
| *1* | NC | 3.4 | 4.8 | 6.5 |
| *2* | 50% | 4.8 | 6.5 | 6.8 |
| *3* | 60% | 4.89 | 6.4 | 7.1 |

**CHART (3) FLEXURAL STRENGTH**




**6. CONCLUSION:**

The following conclusion can be drawn from the results obtained from the experimental investigations. Use of magnetic water, reduce the voids and crack and increase the workability and bond strength. Permeability is reduced by use of steel slag.

The specimen cast with 50% Steel slag and Magnetic water replacement by Coarse aggregate gives better compressive strength of 1.38% increased, split tensile strength of 1.27% increased, and flexural when to compare to conventional concrete.

The specimen cast with 60% Steel slag and Magnetic water replacement by Coarse aggregate gives better compressive strength of 1.55% increased, split tensile strength of 1.3% increased, and flexural strength of 1.09%. when to compare to conventional concrete.

The specimen cast with 70% Steel slag and Magnetic water replacement by Coarse aggregate gives better compressive strength of 1.87% increased, split tensile strength of 1.36% increased, and flexural strength of 1.2%. when to compare to conventional concrete.

**7.SCOPE FOR FURTHER STUDY:**

- A much more extensive study on the properties and behaviour of concrete with magnetic water can be made.
- Investigation may be done for higher grades of concrete and with different water cement ratios with same materials.
- Study on concrete with full/partial replacement of steel slag as both fine aggregate and coarse aggregate can be done.
- Further investigation on resistance of concrete with steel slag aggregates to attack by sulphates, acid, and alkali silica reactions, carbonation, harmful chemicals and resistance to high temperatures can be carried out.
- A broad study can be done on durability characteristics of concrete with steel slag as coarse and fine aggregate replacements.

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