# Assessment of Mix Design of Replacing Sand by Waste Foundry Sand (Green Concrete)

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*Abstract*— Waste foundry sand is major disposable item of metal casting industries. Provide a new source for construction functions. The introduction of foundry sand as fine aggregates replacement materials in concrete looks to achieve success recently. The use of foundry sand as a substitute for fine aggregates in concrete mix is one option that can foundry sand disposal problem. Experimental investigations were performed to study the strength properties of M-25 grade of concrete mix, with partially replaced sand with waste foundry sand (WFS). Compression test & flexural strength test to evaluate the strength properties of concrete at the age of 7, 14, and 28 days. Results showed that there were optimum strength properties at 25% replacement of fine aggregate with WFS for M-25 grade of concrete.

***Keywords:*** WFS, Compressive Strength Test, Green Concrete

## I. INTRODUCTION

### A. General:

In the current scenario, the construction works is everywhere, which leads to various environmental hazards. The construction industry has ruined the ecological balance up to a great extent by taking away the natural stock of aggregates. The air pollution from quarrying caused by release of suspended particulate matter into the atmosphere leads to danger for the working staff and the adjoining population.

The large use of concrete thanks to boom in urbanization and manufacture has resulted within the over-extraction of river sand from the stream bed [1]. Thus, it's become imperative to appear for various to natural stream sand [2, 3]. With close to 5000 foundries and put in capability of fifteen Million metric tons/annum the annual production of nearly nine.3 Million Metric tons is reported for 2012–13. The put in capability and output may well be truly beyond estimate since the world is majorly (around 85%) unorganized that doesn't reports publically [4], [5],[6].

### B. Manufacturing of Foundry Sand

While the sand is usually used multiple times among the manufacturing plant before it becomes a by-product, only 10 % of the manufacturing waste foundry sand. Whereas actual numbers aren't available, the most effective estimate is that around ten million a lot of foundry sand will beneficially be used annually.

### C. Physical Properties

Relying upon the business sector from that it originates, variety of casting method, variety of additives used for molding, range of times the sand is recycled and kind and quantity of binder used, its physical and chemical characteristics could vary [7], [8]. concerning 85–90% of its particles area unit smaller than a 100mm. it's principally made up of sand that is clear from the particle size (0.05–2 mm) of WFS, obtained from thirty-nine foundries, starting from seventy six.6% to 100%, with a median of ninety.3% [9]. [10]. As per the particle size distribution of the mill sand, the dimensions comparable to 500th of passing (d50) was around 33 mm and average diameter of foundry sand particle was determined to be 28.8 mm [11,12]. The particle form is often sub angular to spherical and it doesn't meet the graduation needs for fine aggregates as per ASTM C33 [13].

## II. LITERATURE REVIEW

### A. General

Natural sand is getting depleted due to large-scale construction There are many types of waste material by products that are explored for attainable use in concrete as a partial replacement of fine mixture. Such sorts of materials are coal bottom ash recycled fine mixture, sewerage sludge ash, stone dust and glass cullet, and waste foundry sand, etc. Divya.M.R (et al.), (2018), were concluded that Among the various mixes it was observed at the age of 28 days the maximum strength attained at 15% of foundry sand with 10% of cow dung ash. Use of cow dung ash in higher proportion reduces the strength and hence, a constant value of 10% is maintained throughout the project. This concrete preparation is eco-friendly and cost effective. The degree of workability of concrete was normal with the addition of Cow Dung Ash and Foundry sand for M20 grade concrete. The main advantage being reduction of environmentally hazardous material and increasing the strength of concrete to a considerable percentage.

Dsouza, V., (2017) were concluded that the From the results of characterization of material, Workability of Concrete, Compressive Strength Test, Split Tensile Strength Test and Flexural Strength Test on M25 grade of concrete, made of different mixes with 10%, 20%, 30%, 40% and 50% replacement level of Waste Foundry Sand. For the grade of concrete considered for the study at 0.45 water cement ratio, Mix-2 i.e. the ratio of 80:20 of Conventional Sand: Foundry Sand has proved to be having optimum ratio which gives maximum Compressive strength of all ratios. ii. At the higher replacement levels of 30%, 40% and 50% the strength decreases considerably when compared to that of NC mix.

Sarita Chandrakanth and Ajay.A.Hamane (2016) were complete that Low price concrete production by replacement of fine sand with foundry sand could be a new trend and makes effectively use of Waste foundry sand as engineering material by reducing disposal and pollution downside. Waste foundry sand is by-products that seem to possess the potential to partly replace regular sand as a fine combination in concretes, providing a utilisation chance for them. it's found that compressive strength of concrete combine is will increase with increase in share of waste

 

foundry sand and recycled aggregate as compare to traditional concrete. it was most for 400th replacement subsequently it reduces. it's conjointly found that split lastingness will increase with increase in share of waste foundry sand and recycled combination up to 40%replacement subsequently it reduces. it's conjointly found that flexural strength will increase with increase in share of waste foundry sand and recycled combination up to 40%replacement subsequently it reduces. Increase of average compressive strength 4.47%, 10.615% & 4.237% as compared to standard concrete. Increase in average split lastingness 15.38%, 34.10% & 17.554% as compared to standard concrete. Increase in average split tensile strength 21.99%, 35.67% & 19.50% as compared to standard concrete.

## III. Results and Discussion

### A. *Compressive Strength Test (M-25)*

Compressive Strength test is carried out on specimen cubes of Concrete mix.

| Serial no. | % of WFS | Compressive Strength (N/mm$^2$) | | |
|---|---|---|---|---|
| | | 7 days | 14 days | 28 days |
| 1 | 0 | 17.19 | 22.67 | 28.89 |
| 2 | 5 | 18.52 | 23.85 | 30.07 |
| 3 | 10 | 19.11 | 25.04 | 31.26 |
| 4 | 15 | 19.70 | 25.93 | 32.15 |
| 5 | 20 | 21.04 | 27.11 | 33.33 |
| 6 | 25 | 22.07 | 28.59 | 34.81 |
| 7 | 30 | 21.19 | 26.37 | 33.19 |

Table 1: Compressive Strength of cubes for 7, 14 and 28 days (M-25)

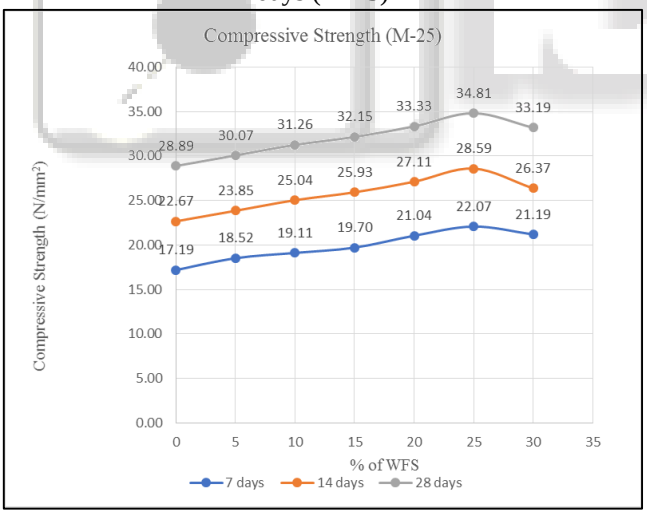


Fig. 1: Compressive Strength of cubes for 7, 14 and 28 days (M-25)

### B. *Flexural Strength Test (M-25)*

Flexural Strength test is carried out on specimen Beam of Concrete blended with various percent replacements to fine aggregate by Waste foundry sand (varying percentages) and conventional Concrete at 7, 14 and 28 days.

| Serial no. | % of Waste Foundry Sand | Flexural strength (N/mm$^2$) | | |
|---|---|---|---|---|
| | | 7 days | 14 days | 28 days |
| 1 | 0 | 1.48 | 2.79 | 3.73 |
| 2 | 5 | 1.69 | 3.00 | 3.95 |
| 3 | 10 | 1.79 | 3.09 | 4.04 |
| 4 | 15 | 1.93 | 3.24 | 4.26 |
| 5 | 20 | 2.18 | 3.48 | 4.43 |
| 6 | 25 | 2.31 | 3.61 | 4.59 |
| 7 | 30 | 2.23 | 3.54 | 4.36 |

Table 2: Flexural Strength of Beams for 7, 14 and 28 days (M-25)

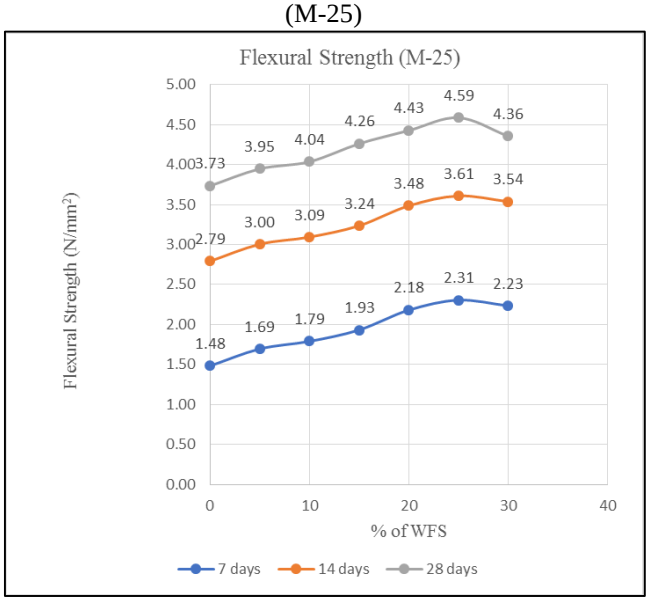


Fig. 2: Flexural Strength of Beams for 7, 14 and 28 days (M-25)

## IV. Conclusions

- The values that are obtained increased at 7, 14 and 28 days of curing for increase up to 25% and then decreased of Waste foundry sand replaced by fine aggregate.
- At 25% Waste foundry sand replacement to fine aggregate increases compressive strength than conventional concrete in 28 days about 20.49% in M-25 grade concrete.
- The Flexural strength increases with the increase in Waste foundry sand compared with normal concrete. The values that are obtained increased at 7, 14 and 28 days of curing for increase up to 25% and then decreased of Waste foundry sand replaced by fine aggregate.
- At 25% Waste foundry sand replacement to fine aggregate increases flexural strength than conventional concrete in 28 days about 23.62% in M-25 grade concrete.
- The workability of concrete decreases from medium to low with an increase in content of Waste foundry sand.
- The compressive strength increases with the increase in WFS compared with normal concrete.
- When the fine aggregate is replaced with 25% WFS gives the optimum compressive strength.
- When the fine aggregate is replaced with 25% Waste foundry sand gives the optimum Flexural strength.

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