# USE OF DIFFERENT MATERIALS FOR PARTIAL SUBSTITUTION OF FINE AGGREGATES WITH MIX PROPORTION M35

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**Abstract -** This paper under seeks the effect on the compressive strength and split tensile strength of concrete by partial replacement of fine aggregates by mixture of ceramic tile powder and brick powder in equal proportions the reason for using ceramic as fine aggregates is that it is a waste material usually found in the form of damaged roof tiles. Brick makes cement mortar and concrete more water proof and also more resistant to alkali and salt action as compared to those in which no brick powder is present. Thus, this combination of ceramic and brick powder as replacement of fine aggregates not only makes the concrete mix economical but also makes it more resistant to various attacks, that to without decreasing its strength. For conducting the tests, initially a portion of conventional fine aggregate (i.e. sand) was replaced by equal proportions of ceramic and brick powder till all of fine aggregate got replaced. The results obtained from various tests conducted on concrete of grade M35 analyzed and ultimately compared to that of the standard M35 grade. It was observed that with increase in the percentage of ceramic and brick powder the compressive and split tensile strength of the concrete mix increased, with its maximum value for the specimen in which 80% of the fine aggregates got replaced by mixture of ceramic and brick powder. For the specimen in which all of conventional fine aggregate was replaced by mixture of ceramic and brick powder, there was a slight decrease in values of compressive and split tensile strength.

**Keyword- Compressive strength, spilt tensile strength, slump test, water-cement ratio.**

## 1.NTRODUCTION

Electric ceramic insulators find their use in applications that require a nonconductive rigid element for the dissipation of heat. Ceramic electrical insulators are used in electrical equipment's to support and separate electrical conductors without allowing current through them. However, it is unrealistic to expect that every insulator will last forever and never fail. Nowadays insulators have reached a high level of reliability. But still failures can and do occur due to inferior design and materials, improper manufacturing, flashover across insulator, misapplication of the insulator for its intended service, extreme stresses linked to weather, vandalism, wildlife or mishandling. Because of these failures the insulator can no longer be used and finds its worth as a waste material. Thus, its use as a fine aggregate not only serves structural purposes but also mitigates its disposal problems. Surkhi has often been used as a substituent of sand as it imparts strength and hydraulicity to concrete. Surkhi is a pozzolanic material which also increases the water proofing ability of the concrete. It not only imparts strength to the concrete but also increases the economy of the concrete to a considerable extent. It is made by grinding burnt bricks, brick-bats, or burnt clay to powder. Surkhi not only makes the concrete water proof and resistant to alkali attack but also reduces cracking and temperature rise during hydration in a mass cement concrete. Surkhi has often been used as a substituent for fine aggregates. But in this study, it is used in combination with the ceramic powder. In order to use ceramic and surkhi mixture as fine aggregate in concrete these materials need to be grinded to obtain their powdered form. The powdered form was properly sieved passing through 4.75mm sieve.

## 2.LITERATURE SURVEY

Several studies have been conducted on the use of waste materials such as ceramic tile powder and brick powder in concrete mixes. The main aim of using these materials is to reduce the environmental impact of concrete production by utilizing waste materials as partial substitutes for natural aggregates. One study investigated the effect of using ceramic tile powder as a partial replacement for fine aggregates in concrete mixes. The results showed that up to 15% of fine aggregates could be replaced with ceramic tile powder without adversely affecting the mechanical properties of the concrete. However, beyond 15% substitution, the compressive strength and workability of the concrete were negatively affected. Another study examined the use of brick powder as a partial replacement for fine aggregates in concrete mixes. The results showed that up to 20% of fine aggregates could be replaced with brick powder without significantly affecting the compressive strength of the concrete. However, beyond 20% substitution, the compressive strength and workability of the concrete were negatively affected. In another study by Poon and Shui (2004), brick powder was used as a partial replacement for fine aggregates in concrete mixtures with a proportion of M35. The researchers found that the use of brick powder as a partial replacement for fine aggregates resulted in a reduction in the compressive strength of the concrete. However, the reduction in compressive strength was not significant when the replacement level was below 30%.

## 3. MATERIALS AND METHODS

### 3.1. CEMENT

Cement is a binder material that is widely used in construction. It is made by grinding together a mixture of limestone and clay, and then heating it to a high temperature in a kiln. The resulting product is a fine powder that can be mixed with water to form a paste, which hardens over time to become a solid material.

**Fig-3.1 Cement**

### 3.2. SAND

Sand is a granular material composed of finely divided minerals particles. Sand has various compositions but is defined by its grain size. Sand grains are smaller than gravel and coarser than silt

**Fig-3.2 Sand**

### 3.3.COARSE AGGREGTES

Coarse aggregate is the irregular and granular materials such as sand, gravel, or crushed stone and are used for making concrete. The sieve size of the particles of sand was 4.75mm. **Fig-3.3 Coarse aggregates**

### 3.4. CERAMIC TILE POWDER

Ceramic tile powder is a by-product of the ceramic industry, and it is often used as a partial replacement for cement in concrete production. The addition of ceramic tile powder in concrete improves its durability and strength properties. Studies have shown that the use of ceramic tile powder in concrete can improve its compressive strength, tensile strength, and flexural strength. This is because ceramic tile powder contains silica, alumina, and other mineral compounds that react with the cement to produce a stronger and more durable concrete. Furthermore, the use of ceramic tile powder in concrete reduces the porosity of the concrete, which makes it more resistant to moisture and chemical attacks. This improves the overall durability of the concrete and makes it suitable for use in high traffic areas, industrial applications, and other harsh environments.

**Fig-3.4. Ceramic tile powder**

### 3.5. BRICK POWDER

Brick powder refers to the fine particles that result from crushing or grinding bricks into small pieces. It is commonly used as an additive in building materials such as concrete, mortar, and plaster to enhance their properties. Brick powder can also be used as a coloring agent for creating different shades of red, brown, or yellow in various construction applications. Additionally, it is used in the production of bricks, tiles, and other ceramic products. Brick powder is also utilized in agriculture to improve soil fertility and in the manufacturing of refractory materials for high-temperature applications

**Fig-3.5 Brick powder**

## 4. RESULT AND DISCUSSION

### COMPRESSIVE STRENGTH OF SAND WAS REPLACED WITH BRICK POWDER

| Sam. No | W/c ratio | % Brick powder | Compressive strength MPa | | | |
|---|---|---|---|---|---|---|
| | | | 7 days | 14 days | 21 days | 28 days |
| 1 | 0.32 | 5% | 25 | 28 | 35 | 39 |
| 2 | 0.32 | 10% | 24 | 31 | 34 | 38 |
| 3 | 0.32 | 15% | 21 | 25 | 28 | 31 |

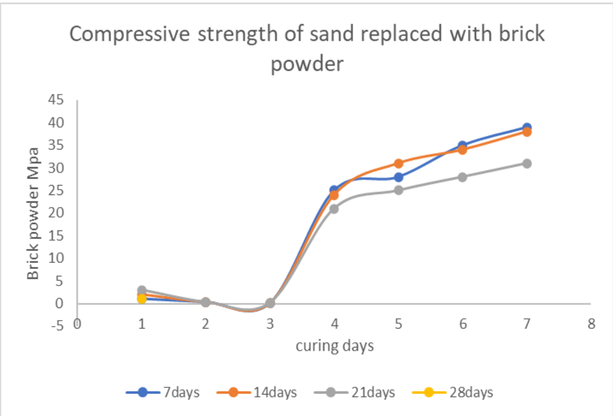


**Figure-4.1 Compressive strength of sand replaced with brick powder**

### 4.2 SPILT TENSILE STRENGTH OF CONCRETE

SPILT TENSILE STRENGTH OF CONCRETE

The spilt tensile tests were conducted on a compression testing machine after 7days and 28 days curing with load being applied gradually. Load recorded at the failure was used to calculate the split tensile strength of concrete by using the formula.

Tsp=2P/pi D

Where Tsp = Spilt tensile strength

P = Load at failure

D = Diameter of the specimen

L = Length of the specimen

| S.NO | Specimens | Weight | Split tensile strength after 7days | Split tensile strength after 28days |
|---|---|---|---|---|
| 1 | J1 | 3.80 | 1.88 | 2.84 |
| 2 | J2 | 3.78 | 1.84 | 2.93 |
| 3 | J3 | 3.72 | 2.16 | 3.24 |
| 4 | J4 | 3.75 | 2.39 | 3.83 |
| 5 | J5 | 3.71 | 1.71 | 2.64 |

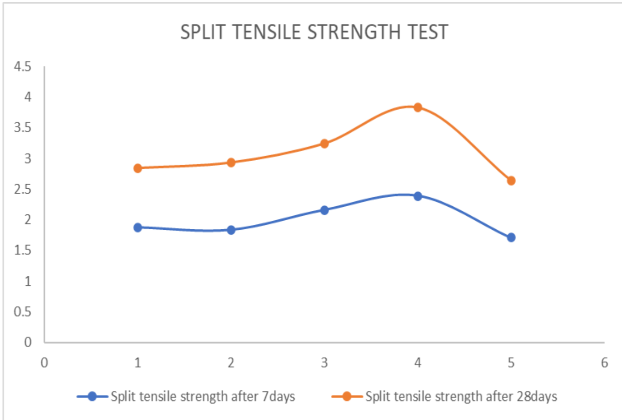


**Figure-4.2 SPLIT TENSILE STRENGTH**

### 4.3 SPILT TENSILE STRENGTH OF SAND REPLACED CERAMIC TILE POWDER.

| Sam. No | W/c ratio | % ceramic tile powder | Compressive strength MPa | | |
|---|---|---|---|---|---|
| | | | 7 days | 14 days | 28 days |
| 1 | 0.32 | 5% | 1.52 | 1.87 | 2.35 |
| 2 | 0.32 | 10% | 1.64 | 1.92 | 2.16 |
| 3 | 0.32 | 15% | 1.46 | 1.61 | 1.83 |

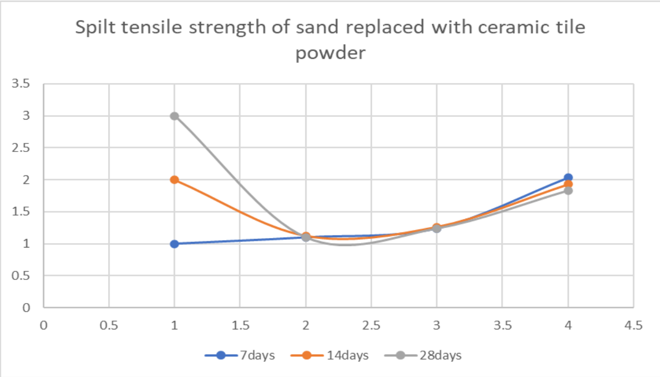


**Figure 4.3 Spilt strength of sand replaced with ceramic tile powder**

### 4.4 SPILT TENSILE STRENGTH OF SAND REPLACED WITH BRICK POWDER

| Sam. No | W/c ratio | % of Brick powder | Compressive strength MPa | | |
|---|---|---|---|---|---|
| | | | 7 days | 14 days | 28 days |
| 1 | 0.32 | 5% | 1.10 | 1.24 | 2.03 |
| 2 | 0.32 | 10% | 1.12 | 1.26 | 1.93 |
| 3 | 0.32 | 15% | 1.10 | 1.24 | 1.83 |

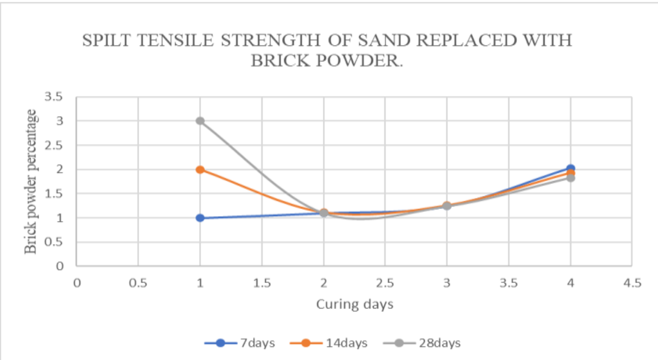


**Figure 4.4 Spilt tensile strength of fine sand replaced with brick powder**

## CONCLUSSION

Increase in the value of strength without a considerable increase in the economy of the concrete construction has always been the main talking point of the advancements made in the field of the concrete technology. Researchers have always tried to make the concrete economical by replacing either aggregates or by making use of other pozzolanic agents. In this research paper, the fine aggregates were replaced in a definite pattern by waste materials like ceramic powder and surkhi. This replacement not only made the concrete economical but also increased its strength properties to a considerable extent with a maximum compressive and split tensile strength of 3.83N/mm2 for an M35 grade of concrete. In the specimen, 80% of sand was replaced by mixture of ceramic and surkhi powder. In future, the use of such waste materials as fine aggregates on large scale can decrease the overall cost of the production.

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