

# Evaluating The Characteristics of Concrete Using Different Aggregates: A Review

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**Abstract-** Over 60-65% of concrete is made up of aggregates, which also play a big role in its strength. In this work, elongation and thickness gauge are used to calculate shape properties such as flakiness and elongation. Granite was employed as the study's aggregate. Substantial designs redirect, break, and free firmness when exposed to outer burden. Loss of flexural strength of cement is to a great extent liable for breaks in structure. In built up substantial designs, the blend extents of the materials of the substantial and total sort decide the compressive strength while the composite activity of cement and steel support supplies the flexural strength. In event of loss of firmness, steel support no longer backings flexural stresses; concrete thus is exposed to flexure. The compressive strength and flexural strength thusly assume an essential part. Impact of shifting coarse total size on the flexural and compressive qualities of cement footer was explored.

**Keywords-** Concrete, aggregate, flaky, flexural and compressive strengths

## I. INTRODUCTION

Only water is used more frequently around the world than concrete, which is thought to be the most widely used man-made material. One of the most important building components, it is also very inexpensive, easy to make, offers continuity and solidity, and readily bonds to other materials. Cement, fine aggregate (sand), coarse aggregate (crushed or uncrushed stones), and water are all present in the proper proportions. The key to producing high-quality concrete lies in the raw ingredients required. Concrete's strength has been discovered to be significantly influenced by the water-cement ratio, slump, cement-to-aggregate ratio, cement quality, aggregate gradation, and curing procedure efficiency. The specific gravity, particle size analysis, shape, and surface texture of the aggregates have a considerable impact on the characteristics of wet and hardened concrete, whereas the elastic modulus, toughness, and mineralogical composition have a substantial impact on the hardened state of concrete.

## Aggregates

The vital component of concrete that gives it structure and minimises shrinkage is called aggregates. 70 to 80 percent of the entire volume of concrete is made up of aggregates. So, it can be concluded that in order to learn more about concrete, one must unquestionably have a thorough understanding of aggregates.

## II. LITERATURE REVIEW

**Aves and Jr (2022)** examined the compressive strengths of concrete built with fine and coarse particles from five different regions. Several physical tests, including those for specific gravity and absorption, sieve analysis, abrasion testing, workability testing, and compressive strength testing, were used to assess the application of these aggregates on the compressive strength of concrete.

The results showed that the average compressive strength of concrete formed from fine and coarse aggregates from natural river quarry sites was 23.465 MPa, and that provided crushed fine and coarse particles had an average compressive strength of 19.555 MPa. The aggregates from rivers that occasionally experienced saline water intrusion had a lower average compressive strength (18.54 MPa). For 7, 14, and 28 days, compression strength observations were made.

**Ndon and Ikpe (2021)** analysed the compressive strength of concrete made with various crushed stone sizes (e.g., 3.35mm–10mm, 13.2mm–19mm, and 20mm–28mm) in order to identify the variations in strength between the various sizes of crushed stones that were tested after 7 days, 14 days, and 28 days of crushing.

According to the findings, compressive strength increased with increasing coarse aggregate size. It also demonstrated that the strength of concrete increased with the number of curing days and, finally, that concrete cubes created with larger coarse aggregate sizes were found to weigh more than those generated with smaller coarse aggregate sizes. Larger aggregate should be utilised for foundation construction because it has a higher compressive strength.

**Pertiwi et.al (2021)** the effect of coarse particles on the compressive strength of concrete was examined. Using natural river sand as the fine aggregate, ordinary Portland cement as the coarse aggregate, and polymer admixture to ensure workability, two concrete samples (CS1 and CS2) were created. 5 mm–10 mm and 10–20 mm coarse aggregate combinations were used. Additionally, specimen controls were made for each circumstance. The water-cement ratio of 1: 2: 4 and 0.55 was kept, and the planned concrete slump flow was 60-5 mm.

A 300 x 300 mm concrete cylinder was tested for compressive strength after 28 days of curing. CS1 had the highest compressive strength, measuring 33.28 MPa, while CS2 came in second with 36.10 MPa. These different compressive strength traits were obtained when the coarse aggregate was resized, demonstrating the influence of coarse aggregate size on concrete. Additionally, the size of the coarse aggregate has little effect on how well the concrete performs.

**Lee et.al (2021)** taken a gander at the compressive qualities of cement for different ages in view of water content and total volume parts, for example, ridge sand (DS), squashed sand (CS), and coarse total (CA). Utilizing trial information, the impacts of changes in total volume part on compressive strength were researched. Compressive strength of substantial increments until the volumetric DS to fine total (FA) proportion (DS/FA proportion) comes to 20%, past which it will in general diminish. The connection between compressive strength varieties and total volume portions was examined under two unique conditions, considering the impacts of each total on compressive strength: (2) 0 CA CS DS and (1) 0 DS CS CA When condition (1's) impact element of CA = 1, the reaches for DS and CS for all combinations were, individually, 0.04-0.83 and 0.72-0.92. The CS and CA values fell between the scopes of 0.68-0.80 and 0.02-0.79, individually, when the DS impact factor for condition (2) was 1.

The downturn/Promotion proportion expanded, while the DS/FA proportion expanded by up to 40%, as indicated by the outcomes. For substantial functionality, for instance, a DS/FA proportion of 40% was great. Compressive strength of cement expanded till the DS/FA proportion came to 20%. After then, the compressive strength diminished as the DS/FA proportion rose. For a similar DS/FA proportion, the compressive strength regularly increments emphatically as water content reductions. Changes in the DS/FA proportion greater affected contrasts in compressive strength than did changes in the unit water content. Thusly, while surveying the strength of cement worked with DS and CS, the DS/FA proportion ought to outweigh the unit water content.

**Bian et.al (2021)** identified peak stress and elastic modulus of recycled concrete using the response surface methodology to develop regression equations. Design considerations include coarse aggregate content, aggregate form, and maximum aggregate size. Experiments, theoretical research, and numerical modelling were used to evaluate how aggregate quality affected the mechanical characteristics of recycled concrete.

The peak stress and elastic modulus of recycled concrete were found to be at their best when the coarse aggregate content was 45 percent, the maximum coarse aggregate size was 16 mm, and the regular round coarse aggregates made up 75 percent of the mixture. The maximum aggregate size and aggregate shape remain constant while the peak stress and elastic modulus of recycled concrete first climb and then fall with an increase in the amount of coarse aggregate. While the maximum aggregate size increases, the peak stress and elastic modulus of recycled concrete fall while the coarse aggregate concentration and aggregate shape remain unchanged. While the fraction of coarse aggregate and maximum aggregate size remain constant, the peak stress and elastic modulus of recycled concrete increase as the amount of regular round aggregates increases.

**Nisa and Kumar (2021)** examined the shape of coarse aggregate particles has been linked in the research paper to the workability and compressive strength of cement concrete for stiff pavements. We identified the shape characteristics, such as sphericity, flatness, form factor, and elongation. The slump and compressive strength of cement concrete were also tested for several types of coarse aggregate.

A significant correlation between several aggregate shape parameters, workability, and compressive strength was demonstrated by the experimental data. The concrete constructed using different kinds of coarse particles exhibited the maximum compressive strength over time. The results indicate that the shape of the coarse aggregate influences the strength of concrete, which leads to the conclusion that when deciding whether or not to use coarse aggregate to prepare cement concrete for rigid pavements, the shape of the aggregate should be taken into consideration as a crucial factor.

**Chhetri et.al (2021)** investigated the effect of coarse aggregate size on compressive strength of concrete. For this, four sources were selected from the Seti River's whole length. The coarse aggregate from these sources was collected and sieved to produce aggregate samples of the required size. The coarse aggregate obtained from these sources was put through physical tests like specific gravity and water absorption. There

were mechanical tests performed, including the Los Angles test, impact value test, and aggregate crushing strength test. The outcomes of the mechanical test showed that all of the aggregates are top-notch building materials, with just small variations in their mechanical properties. Concrete cubes of M20 grade nominal mix by volume were cast using a consistent cement, sand, and water cement ratio for each source while altering the coarse aggregate size. Five distinct batches of aggregate were cast, with the size ranges being 20mm-25mm, 16mm-20mm, 10mm-16mm, 10mm-25mm, and 4.75mm-25mm. In comparison to other cubes, the one made from properly graded aggregate (4.75mm–25mm) had greater strength. Bond failure for every source was the main cause of failure for concrete cubes, which caused the process to begin.

**Oluwasola et.al (2020)** testing on the aggregate crushing value and aggregate impact value were done on the aggregate, while tests on the concrete's slump, water absorption, compressive strength, and flexural strength were done on the concrete. Forty-eight reinforced concrete beams were created for the flexural strength test, and a total of one hundred and thirty-two concrete cubes were created for the compressive strength test using the 1:2:4 and 1:3:6 mixes, respectively. The findings of the slump test showed that a higher proportion of flaky and elongated aggregates impairs workability. If the outcome of water absorption is taken into account, flaky aggregates absorb more water than elongated aggregate. The shape of the aggregate used had a significant impact on the compressive strength of the concrete cube, and it was discovered that when the percentage of flaky and elongated material was low as opposed to high, the compressive strength was somewhat high. The highest compressive strength, 15 N/mm<sup>2</sup>, is consistent with the compressive strength of a typical 1:2:4 mix of concrete. In comparison to the presence of a higher percentage of flaky and elongated aggregate, which results in reduced flexural strength, it was observed that the flexural strength was strong with 30% of elongated aggregate and 30% of flaky.

**Ansari et.al (2020)** examined aggregates before being graded by passing through an IS sieve of retained material and a 20mm filter. The mix design ratio was chosen from the excel sheet we created in accordance with IS 10262 - 2009; the mix ratio of 1:1.9:2.3 was adopted and maintained throughout the trial. Throughout the course of the investigation, a constant cement to sand and water ratio of 0.45 was used. The amount of aggregate used in the study was 820.22kg, while 438.13kg of cement was used. Due to the size and shape of aggregates, the aggregate grading process has a significant impact on the overall performance of aggregates.

The marble, sand stone, and normal aggregate, sand stone aggregates, according to the results, had delivered the highest strength in comparison to both of them. Sandstone aggregate yields the highest value of compressive strength, 33.33 N/mm<sup>2</sup>. The highest compressive strength was found in sandstone that had a gradation of 60–40%. The sand stone aggregate gradation provided the best strength out of all the aggregate gradations. Sandstone should only be utilised in large-scale projects or when a strong structure is required because it is slightly more expensive to employ in every structure. The highest strength of aggregates can be achieved by keeping the w/c ratio, cement content, and sand content constant at 0.45, 438.13, and 820.22, respectively.

### III. DISCUSSIONS AND CONCLUSIONS

The findings demonstrate that shape of the aggregate, along with size of the aggregate and water cement ratio in the mix, should be taken into account as an important parameter in establishing the acceptability of coarse aggregate to make pervious concrete. This is because the strength and permeability of pervious concrete vary as a function of shape of the aggregate.

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