# Experimental Study on Concrete Using Laterite Sand By Replacing Natural Sand

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***Abstract-*** *Aggregates smaller than 4.75 mm that are made from crushed rock or gravel are referred to as manufactured sand. Natural sand resources are becoming more scarce and more expensive as a result of our nation's burgeoning building industry. Therefore, the purpose of this study was to evaluate the costs of various mix compositions and investigate the impact that produced sand has on the compressive strength of concrete.*

*This experiment's work In the specified grade of concrete, the sand will be gradually replaced by 0%, 10%, 20%, 30%, 40%, 50%, and 60% laterite soil. The specimen will be evaluated after seven, twenty-one, and twenty-eight days of curing. for compressive strength and for tensile and flexural strength at a 28-day curing period.*

*According to the results, up to 30% of the fine aggregate in concrete can be replaced with laterite sand.*

***Keywords***- aggregate, compressive strength, concrete, cost, manufactured sand, workability.

## I. INTRODUCTION

After water, concrete is one of the materials that people utilise the most worldwide. Concrete has the special ability to be moulded into any shape. Concrete is a fluid substance made of cement and aggregates mixed with water that solidifies as it sets. River sand, which has historically been utilised as fine aggregate in the production of concrete, is disappearing at a rate never seen before and harming aquatic ecosystems, causing river erosion, and increasing the susceptibility of some regions to floods. River sand is therefore the second most utilised resource on the planet. It is well recognised that producing high-quality concrete is a basic prerequisite for creating concrete buildings. In order to get the best possible result in terms of quality and economy for any purpose, good quality concrete is made by carefully blending cement, water, fine and coarse aggregate, and admixtures as needed.

## II. LITERATURE REVIEW

The impact of employing processed lateritic fine aggregates on the functionality of cement mortars and concretes was examined by Yaragal et al. (2020). According to Indian specifications, lateritic FA is substituted with river sand at weight percentages of 0, 25%, 50%, 75%, and 100% at all fineness levels from Zone I to Zone IV. It was determined that at all replacement levels, the control concrete's compressive strength values were within ±3%.

The effectiveness of cement mortars made using offshore and manufactured sand as substitutes for river sand was examined by Arulmoly et al. in 2021. In this study, offshore sand was used to replace 0, 25%, 50%, and 75% of the produced sand. In both fresh and hardened test results, the blended sand at a 25% substitution of offshore sand for manufactured sand proved to be a workable way to fully replace river sand.

## III. OBJECTIVE

- To create a concrete mix percentage that substitutes laterite for fine aggregate in place of regular strength grades M30
- This study aims to measure the strength of concrete by substituting 0–60% laterite sand for river sand and curing the concrete for 7, 21, 28, and 28 days to measure compressive strength and tensile strength.

## IV. RESULTS AND DISCUSSIONS

### Slump Value

The slump test was used to assess workability after fresh concrete was mixed and filled from the top of the slump mould. The mould was then gently and quickly raised from the concrete, and the height difference indicated the slump value. The concrete slump values for M30 are displayed in Figure 5.1.

TABLE 1 Slump Value, Flow in mmAnd Compaction Factor for M30 Concrete

| SN | Sample Designation | % Replacement laterite sand | Slump Value in mm |
|---|---|---|---|
| 1 | NC | 0 | 95 |
| 2 | M30 LS10 | 10 | 89 |
| 3 | M30 LS20 | 20 | 81 |
| 4 | M30 LS30 | 30 | 79 |
| 5 | M30 LS40 | 40 | 71 |
| 6 | M30 LS50 | 50 | 60 |
| 7 | M30 LS60 | 60 | 50 |

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TABLE 2 Slump Value, Flow in mmAnd Compaction Factor for M30 Concrete

| SN | Sample Designation | % Replacement laterite sand | Slump Value in mm | Compaction Factor | Flow in mm |
|---|---|---|---|---|---|
| 1 | NC | 0 | 95 | 0.93 | 75 |
| 2 | M30 LS10 | 10 | 89 | 0.89 | 70 |
| 3 | M30 LS20 | 20 | 81 | 0.85 | 65 |
| 4 | M30 LS30 | 30 | 79 | 0.83 | 61 |
| 5 | M30 LS40 | 40 | 71 | 0.85 | 55 |
| 6 | M30 LS50 | 50 | 60 | 0.86 | 53 |
| 7 | M30 LS60 | 60 | 50 | 0.81 | 51 |

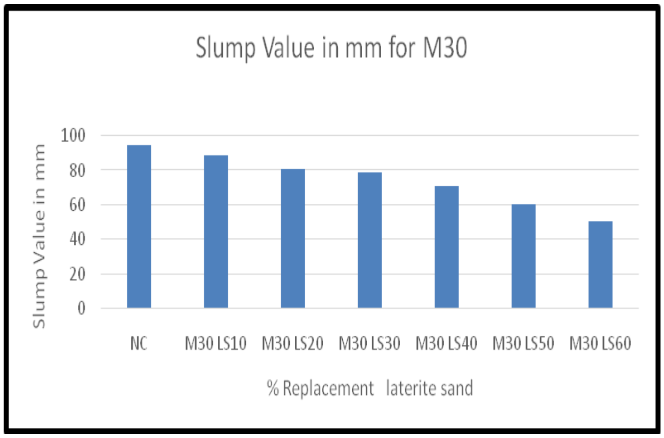


Figure 1 Slump Value in mm for M30 at various percentage of Laterite Sand

Table 3 Compressive strength variation in M30 grade concrete with replacement of fine aggregate by Laterite Sand

| SN | Sample Designation | % Replacement laterite sand | compressive strength in N/mm2 | | | % increse in strength |
|---|---|---|---|---|---|---|
| | | | 7 days | 21 day | 28 day | % increse in strength |
| 1 | NC | 0 | 21.45 | 31.34 | 39.34 | 0 |
| 2 | M30 LS10 | 10 | 22 | 32 | 40 | 1.68 |
| 3 | M30 LS20 | 20 | 23.56 | 33.12 | 41.25 | 4.86 |
| 4 | M30 LS30 | 30 | 27 | 33.45 | 42.67 | 8.46 |
| 5 | M30 LS40 | 40 | 24.75 | 33 | 41.32 | 5.03 |
| 6 | M30 LS50 | 50 | 23 | 29.45 | 38 | -3.41 |
| 7 | M30 LS60 | 60 | 22.34 | 28.45 | 35.76 | -9.10 |

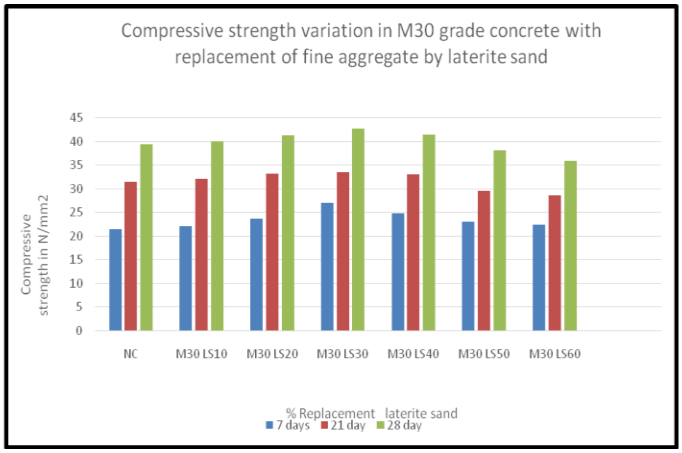


Figure 2 Compressive strength variation in M30 grade concrete with replacement of fine aggregate by Laterite Sand at 7 ,21,28 day

After 28 days of curing, the M30 grade laterized mix with 30% substitution had an 8.46% higher compressive strength than the control mix, while the M45 grade laterized mix with 25% substitution had 8.14% higher strength values than the control concrete. According to the tests, the ideal replacement percentage for fine aggregate in concrete in terms of compressive strength is 30%. This is because the aggregates with rougher surfaces form a stronger connection with the paste, increasing its strength. The rough surface texture and angular particles of C-sand and laterite sand, thus, boost the laterized concrete's compressive strength. Since clay absorbs water and swells, increasing water consumption, the downward trend after 25% replacement may be explained by the higher clay content brought on by the addition of laterite.

## V. CONCLUSION

Concrete with up to 30% laterite replacement outperforms control concrete, according to tests conducted on both fresh and hardened laterized concrete. Because laterite aggregate has a rough texture and dust particles, workability declines as the amount of laterite increases. When the amount of laterite in the mix reaches 60%, the amount of clay increases as well, which impacts the concrete's fluidity and causes the workability of the concrete to decline by 14%, 11%, and 10%. Due to the angular particles of laterite sand, concrete containing laterite greatly improves its strength characteristics by up to 30%. This is because the aggregates with rougher surfaces form a stronger connection with the paste, increasing its strength. Since clay absorbs water and swells, increasing water consumption, the downward trend after 30% replacement may be explained by the higher clay content brought on by the addition of laterite. It has been shown that mixing 30% laterite fine aggregate with 3% C-sand results in a workable concrete that influences strength characteristics after hardening, unlike regular concrete.

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