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# An Experimental Study on Strength of Concrete by Fractional Replacement of Fine Aggregate with P Sand

Prof. Harsh Gupta[1], Sanjay Pratap Singh[2]

[1]PROFESSOR & HEAD OF CIVIL ENGINEERING DEPARTMENT, JNCT REWA M.P. 486001 INDIA

[2]SCHOLAR, CIVIL ENGINEERING DEPARTMENT, JNCT REWA M.P. 486001 INDIA

**ABSTRACT:***Concrete is a composite material made out of both coarse and fine aggregates (River sand is considered as quite possibly the most utilized fine aggregate on the planet, however with the extension of the Construction size of our country, the lack of waterway sand assets is turning out to be more conspicuous. The P-SAND, it can facilitate the lack of river sand and stay away from inordinate sand mining which can bring natural climate issues. The piece of sand is profoundly factor, contingent upon the nearby stone sources and conditions. P-SAND is utilized for putting and making renders both inside and externally, its fine particles of putting sand make an extremely smooth and surprisingly surface. The P-SAND contains regular sand, crushed stone sand or a mix of any of these. The sand will be hard, tough, spotless and liberated from follower covering and natural matter and will not contain earth, residue and residue more than indicated. So the strength and properties of the P-SAND is tried before it is used in this venture. The river sand (fine aggregate) is supplanted via ocean sand as far as 100% and half. One more test is done with supplanting waterway sand with ocean sand alongside GGBS as coarse total and afterward a few tests were done to genuinely look at its solidness. The test outcomes found that it is more important to utilize ocean sand by somewhat supplanting with river sand.*

**Keywords:**Concrete,Constructionmaterial,P-SAND,Concretesolidifies

## 1. INTRODUCTION

Concrete is a composite material made out obviously granular material implanted in a hard network of material that occupies the space among the total particles and pastes them together. Concrete is generally utilized for making compositional constructions, brick/block dividers, asphalts, spans, parkways, runways, stopping structures, repositories, pipes, balance, fences and even boats. Concrete is utilized in huge amounts all over the place. Aggregates comprise of huge pieces of material in substantial blend, by and large coarse rock or crushed rocks, for example, lime stone or stone, alongside better material like sand. Concrete generally Portland cement, and other cementitious materials, for example, fly ash and slag concrete, fill in as cover for the material Water is then blended in with this dry composite, which creates a semi - fluid that specialists can shape (commonly by emptying it into a structure). Concrete sets and solidifies to shake - hard strength through a substance cycle called hydration. The water responds with the concrete, which bonds different parts together, making a hearty stone like material. As of late, it has been considered that the lack of regular fine total is expanding because of the insufficiency of normal sand supply and expanded development requests. To beat the current circumstance specialists are attempting to supplant the substantial materials with new other options.

  

### *2.OBJECTIVES*

- *To determine the possibilities of replacing the sea sand as fine aggregate in concrete. The replacement of P-SAND as aggregate in concrete production not only solves the problem of availability of fine aggregate for concrete production but also helps to reduce the exploitation of the river sand resources.*
- *To provide economical construction material and to safeguard to the environment by adopting the new materials for the concrete production. By using the tests for finding compressive, spilt tensile and flexural strengths of concrete using partial replacement of P-SAND as fine aggregate and comparing with normal concrete we can observe the important of replacement of P-SAND in construction field.*

## 2. SCOPEOFTHEPROJECT

All the engineers need to construct their buildings with full streng thandit should bee conomical too, so because of this reason they are not willing to adopt alternates for the production theconcretebutnowitisnecessarytofindanewalternateforthefineaggregateinconcreteduetothelakeofavaila bilityoftheconventionalfine aggregate,riversand.It'sfoundthatthewashedsea sand has better quality for the replacement of ordinary river sand. The only problem thatfacing for the adoption of P-SAND is nothing but the chlorine content but if we go for washedseasandthechlorinecontentwillbecomewithinthelimit.TheadditionoftheGGBFSasan admixtureintheconcretereducestheeffectofchlorineaswellasitbehavesasathirdaggregateintheconcrete.

## 3. MATERIALSUSED

Concrete production is the process of mixing together the various ingredients like water,aggregates,cementandanyadditives.Concreteproductionistimesensitive.Oncetheingredientsaremi xed,workersmustputtheconcreteinplacebeforeithardens.

***4.1 Cement:*** Concrete is a binder, a substance that sets and solidifies autonomously, and can tie different materials together. The volcanic ash and pulverized brick added substances that were added to consumed lime to get a hydraulic binder cover were subsequently alluded to as concrete. The main property of concrete is that it is latent to all conditions. Concrete utilized for every one of the underlying components was customary Portland concrete of 43 grade adjusting IS 8112. The concrete in standard gunny packs, were set in impermeable steel drum to stay away from the crumbling of the quality. In this project conventional Portland concrete is utilized to make superior cement. This is the normal kind of concrete which is utilized for development of many constructions as mortar and cement, multi-story structures, dams, spans, stockpiling repositories, private structures, streets, runways and so forth, They are additionally utilized for making joints for pipes production of precast lines, heaps, hollow block bricks and so on, In this concrete the higher strength are accomplished by expanding the tri calcium silicate content, aluminum and iron containing clinker and different mixtures. $SiO_2$ will not be under 2. The magnesium oxide content will not surpass 5.0%.

***4.2 Water***: Water is the most essential ingredient in the concrete which reacts with the cement to give the binding property.The proper addition of water will give good workability to the concrete. Portable water with a ph. range of 6-8 was used.

***4.3Aggregates:***Aggregate is a broad category of coarse particulate materials used in construction including sand, gravel, crushed stone, and slag etc. Aggregates are the most mined material in the world. Aggregates are component of composite material like concrete and asphalt concrete.

Aggregates are the major filler materials in the concrete and are divide into mainly 2 types

  

- Coarse aggregate
- Fine aggregate

- ***CoarseAggregate***

Crushed stone is the commonly used coarse aggregate. It is typically produced by mining asuitablerockdepositandbreakingtheremovedrockdowntothedesiredsizeusingcrushers.Itis distinct from gravel which is produced by weathering and erosion typically has a moreroundedshape.

GradedCrushedhardbluegranitejellyavailableinandaroundCoimbatorewasused.

- ***FineAggregate***

TheFineAggregatesusedhereareasfollows.

- ***RiverSand***

Thefineaggregateusedforallthespecimenswasthesandwhichisavailablein Coimbatore.

- ***P-Sand***

CollectednormalP-SANDfromCoimbatoredealer.

### *4.4 GroundGranulatedBlastFurnaceSlag(GGBFS)*

Ground Granulated Blast Furnace Slag (GGBFS) is gained by quenching molten iron slag (aby-productofironandsteelmaking)fromblastfurnaceinwaterorsteam,toyieldaglassy,granular product that is then dried and ground into different shapes. The steel slag here is usedasafillermaterialandthepresenceofslagintheconcretereducetheeffectofchlorinetoo.

## 5.METHODOLOGY

5.1. Concrete production is the method involved with combining as one the different ingredients such as water, aggregates, concrete, and any added substances. Concrete production is time delicate. When the ingredients are blended, laborers should set up the substantial before it solidifies. The concrete is utilized for every one of the underlying components as conventional Portland concrete of 43grade adjusting IS 8112. The concrete in standard gunny sacks was put in a sealed shut steel drum to keep away from the weakening of the quality. his project manages the substitution of P-SAND as a fine aggregate in the customary cement. It made stride by step technique for the finishing of the proposed project along these lines and periodical fulfillment of the work gave a decent outcome for the investigation. Because of this we can take on P-SAND as fine aggregate in the substantial and can diminish the utilization of conventional sand and its exploitation.

5.2. MixDesignforM20Grade

*5.2.1. Designstipulations*

- Characteristiccompressivestrengthrequired=20N/mm2
- Inthefieldat28daysb
- Maximumsizeofaggregate=20mm(angular)
- Degreeofworkability=0.8(compactionfactor)
- Degreeofqualitycontrol=good
- Typeofexposure=moderate
- Gradingzoneofseasand=III

  

*5.2.2. Testdataformaterials*

- CementusedconfirmingIS8112=OrdinaryPortlandCement
- Specificgravityofcement=3.15
- Specificgravityof
  i) Coarseaggregate=2.74
  ii) Fineaggregate(psand)=2.62
- Free(surface)moisture
  i) Coarseaggregate=NIL
  ii) Fineaggregate=NIL

*5.2.3. Targetmeanstrengthofconcrete*f'ck=fck+t.s

f'ck=20+(1.65x4)

f'ck=26.6N/mm²24

*5.2.4. Selectionofwater-cementratio*

- Thefreewater-cementratiorequiredforthetargetmeanstrengthof26.6N/mm'is 0.4.0.4islowerthanthemaximumof0.5.

*5.2.5. Selectionofwaterandsandcontent*

- From IS 10262: 1982 at table 4, 20mm nominal maximum size of aggregate andsand conforming to grading zone III, water content per cubic meter of concrete is186kg.
- Sandcontentaspercentageoftotalaggregatebyabsolutevolumeis35%.Therefore,requiredsandcontentas%oftotal=35-5.1
- Aggregatebyabsolutevolume=29.9%
- Requiredwatercontent=186+186x6/100
  =197litres.

*5.2.6. Determinationofcementandwatercontent*

- W/c=0.5.
- Water=197kg/m3
- Cementcontent=197/0.5
  =394kg/m3

*5.2.7. Determinationofcoarseandfineaggregate*

- FromIS10262-1982attable3.Forthespecifiedmaximumsizeofaggregateof20mm,theamountofentrappedairinthewetconcreteis2%.
- Massofcourseaggregate=exvolumeofcoarseaggregatexspecificgravityofCoarseaggregatex1000
  =0.678x2.74x1000x0.62
  =1151.78kg/m3
- Massoffineaggregate=exvolumeoffineaggregatexspecificgravityoffineAggregatex1000
  =0.38x2.62x0.678x1000
  =675.01kg/m3.

Themixproportionsthenbecome,

  

Table 1. Mix Proportion Values

| | CEMENT | FINE AGGREGATE | COARSE AGGREGATE | WATER |
|---|---|---|---|---|
| **Testingof Specimens** | 394 | 1150.78 | 675.02 | 195 |
| | 1 | 1.72 | 2.93 | 0.5 |

Table2.CompressiveStrengthofCubeSpecimens

| Grade of Concrete | % Replacement of Fine Aggregate | Compressive strength of Concrete | | | Mean Compressive strength N/mm2 |
|---|---|---|---|---|---|
| | | 7 days | 14 days | 28 days | |
| M20 | 100% | 16.32 | 18.27 | 24.37 | 19.65 |
| | 50% | 16.62 | 18.60 | 24.81 | 20.01 |
| | 50% with GGBS | 16.87 | 18.89 | 25.19 | 20.32 |
| | Conventional Concrete | 16.22 | 18.16 | 24.22 | 19.53 |

**The results are shown in graphical representation**

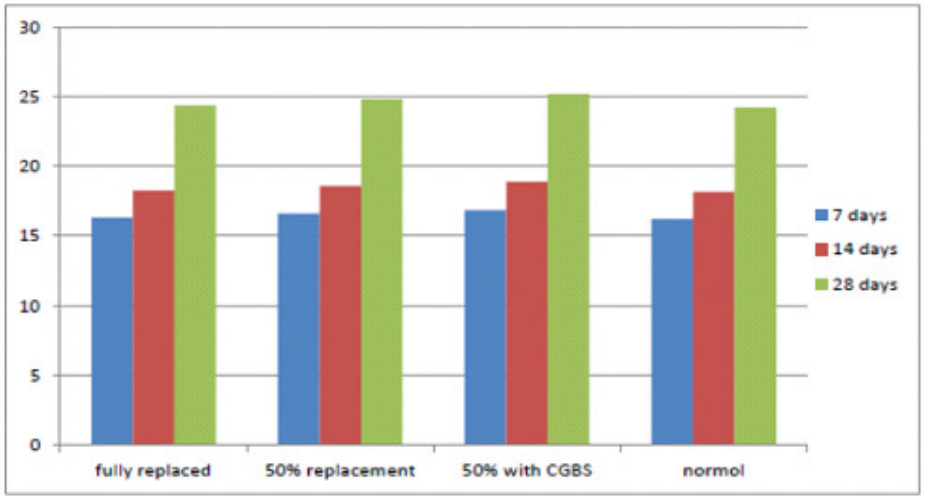


Fig. 5.1: Graph showing the variation in compressive strength

  

Table3.SplitTensileStrengthofCylindricalSpecimens

| Grade of Concrete | % Replacement of Fine Aggregate | Split Tensile Strength of Concrete | | | Mean Split Tensile Strength N/mm2 |
|---|---|---|---|---|---|
| | | 7 days | 14 days | 28 days | |
| M20 | 100% | 2.04 | 2.08 | 3.04 | 2.39 |
| | 50% | 2.07 | 2.12 | 3.10 | 2.43 |
| | 50% with GGBS | 2.22 | 2.29 | 3.14 | 2.55 |
| | Conventional Concrete | 2.18 | 2.27 | 3.02 | 2.49 |

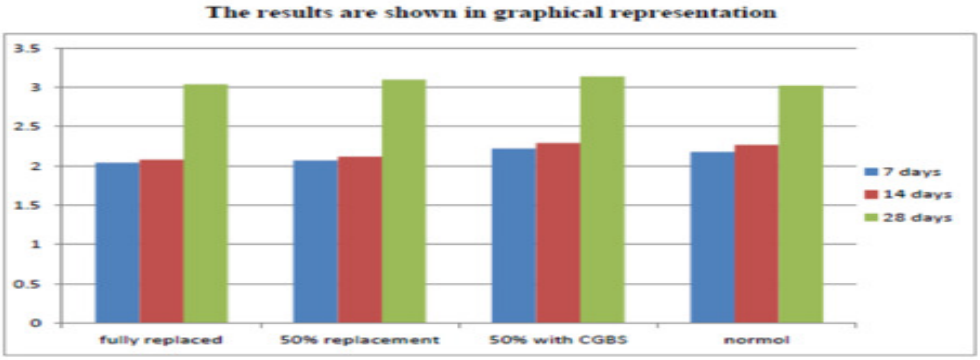


Fig 5.2: Graph showing the variation in split tensile strength

Table4.FlexuralStrengthofPrismSpecimens

| Grade of Concrete | % Replacement of Fine Aggregate | Flexural Strength of Concrete | | | Mean Flexural Strength N/mm2 |
|---|---|---|---|---|---|
| | | 7 days | 14 days | 28 days | |
| M20 | 100% | 2.33 | 2.55 | 3.54 | 2.81 |
| | 50% | 2.39 | 2.69 | 3.72 | 2.93 |
| | 50% with GGBS | 2.53 | 2.83 | 3.77 | 3.04 |
| | Conventional Concrete | 2.43 | 2.72 | 3.63 | 2.94 |

  

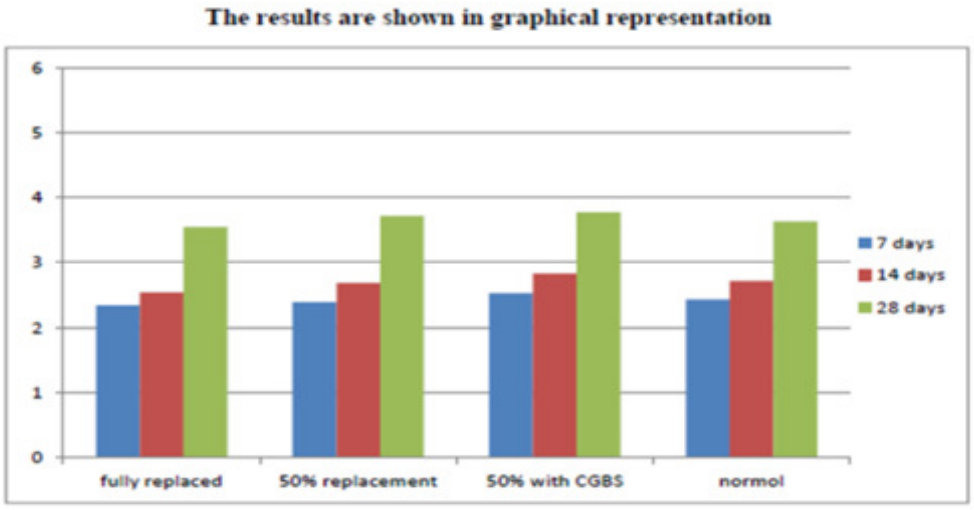


Fig. 5.3 Graph showing the variation in flexural strength

## 6. CONCLUSION

From the outcomes it has been tracked down that because of the absence of accessibility of river sand and the exploitation of the resources, the need for another for river sand as fine aggregate in concrete has gotten vital. The recognizable expansion in different strength of cement because of incomplete supplanting of P-SAND with GGBS as fine total contrasted with typical cement proposes that P Sand is a decent option for river sand and is demonstrated in table below.

| RESULTS | 7th day of Curing | 14th day of Curing | 28th day of Curing |
|---|---|---|---|
| Compressive Strength (%) | 4.007 | 3.678 | 4.004 |
| Split tensile strength (%) | 1.834 | 2.880 | 3.973 |
| Flexural Strength (%) | 4.115 | 4.044 | 3.856 |

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