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# Performance Evaluation of Concrete By Partial Replacement of Fine Aggregates With Iron ore Tailings And Areca Fibers

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***Abstract:***
*Presently a large Amount of IOT generated from various Iron industries and they cause harmful effects to the environment. This paper describes the use of IOT (Iron Ore Tailing) and feasibility in use of it as a partial replacement to sand (or Fine Aggregate).The use of iron ore tailing (IOT) will ensure economy in concrete production as well as a better way of disposing the tailing. Areca fibre is naturally occurring and locally available in and Dakshina Kannada district in coastal and south Karnataka districts.Addition of areca fibre into this concrete was done @ 0.6, 1.2 and 2% by weight to total cementitious concrete.*

***Keywords:****Concrete, Compressive strength, Iron ore tailings(IOT), Fine Aggregate(FA), coarse aggregate(CA).*

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## I. INTRODUCTION

Presently a large Amount of IOT generated from various Iron industries and they cause harmful effects to the environment. This paper describes the use of IOT (Iron Ore Tailing) and feasibility in use of it as a partial replacement to sand (or Fine Aggregate).The use of iron ore tailing (IOT) will ensure economy in concrete production as well as a better way of disposing the tailing. Areca fibre is naturally occurring and locally available in and Dakshina Kannada district in coastal and south Karnataka districts.Addition of areca fibre into this concrete was done @ 0.6, 1.2 and 2% by weight to total cementitious concrete.

## II. MATERIALS AND METHODOLOGY

***1.*Cement**

For makingconcrete OPC 43 grade cement(JP cement)wasused in theresearch.

***Fig.cement***

**2.Fineaggregate**

The aggregate size is lesser than 4.75 mm is considered asfineaggregate.Thesandusedfortheexperimentalprogrammerswaslocallyavailable Narmadasandandconformedtog radingzoneIIasperIS:383-1970.Thespecificgravitywerefoundtobe2.645

***Fig.Fineaggregate***

**3.CoarseAggregate**

Coarse aggregates are those which are retained on IS sievesize4.75mm.Crushedstoneangular shapedof10 mm and20mmsizefromalocalsourcewasusedascoarseaggregate. The specific gravity was found to be 2.85 for 20mm sizeaggregateand 2.80 for10 mm aggregate.

***Fig.CoarseAggregate***

**4.IronOreTailing**

Iron Ore Tailing is the materials left over, after the processofseparatingthevaluablefractionfromtheworthlessfractionofanore.ThephysicalpropertyofIronOreTailings whicharetakenfromHargrahnearSihora,JabalpurMadhyaPradesh(India)

***Fig.Iron Ore Tailings***

*Table: Physical Property of Iron Ore Tailing*

| Parameters | IOT |
|---|---|
| Particle shape | Spherical |
| Specific gravity | 4.3 |
| Color | Dark tan (brown) |
| Optimum dry density(ODD) | 1.71 |
| Density | 14.4 kN/m³ |
| Optimum moisturing content | 21% |

**5.Areca Fibers**

Areca Fiber Is Naturally Occurring And Locally Available Fiber Material .Areca Plantations Dominate The Agricultural Scenario In And Around Dakshnia Kannada District In Coastal Karnataka.


***Fig.Areca fibers***

**MIX PROPORTION**

The concrete mix is designed as per IS 10262 –2009. Thegrade of concrete which weadopted was M30with thewater cement ratio of 0.45. The mix proportions used forconcreteare1:1.9:2.26

**Table-Mix Propotion**

| GRADE | CEMENT | FA | CA | W/C |
|---|---|---|---|---|
| M30 | 492kg | 590kg | 1115kg | 0.45 |

**Test Specimen**

Cubes of size 150mm X150mm X150 mm were preparedusing the standard moulds. The samples were casted usingthe three different percentages of iron ore tailing (4%, 8%,&12%).And three different percentages(0.6%,1.2%,&2%) The samples were demoulded after 24hours from casting and kept in a water tank for 7, 14,and 21 days curing. A total of 42 specimens are casted fortestingthepropertiessuchascompressivestrength.

## III. Results

Theresultsoffreshpropertiesofconcretesuchasworkability by slump cone are determined and hardened properties such as Compressive Strength are presented and discussed below.

**Measurement of workability**

Theresultsoffreshpropertiesofconcretesuchasworkability by slump cone are determined and hardened properties such as Compressive Strength are presented and discussed below

| SL.NO | %IOT | %Areca fibre | Slump in mm |
|---|---|---|---|
| 1 | 0 | 0 | 63 |
| 2 | 12 | 2 | 47 |
| 3 | 8 | 1.6 | 53 |
| 4 | 4 | 0.6 | 60 |

***Table- Workability (Slump cone Test)***

As percentage IOT and ARECA increases workability decreases.

**COMPRESSIVE STRENGTH**

Compressivestrengthtestwereconductedon150mmsizeconcretecubesincompressivetestingmachineaccordancewithhthespecificationsofBureauofIndianStandards. Compressive strength calculated by using formula

F=P/A

Where F= compressive strength in $N/mm^2$

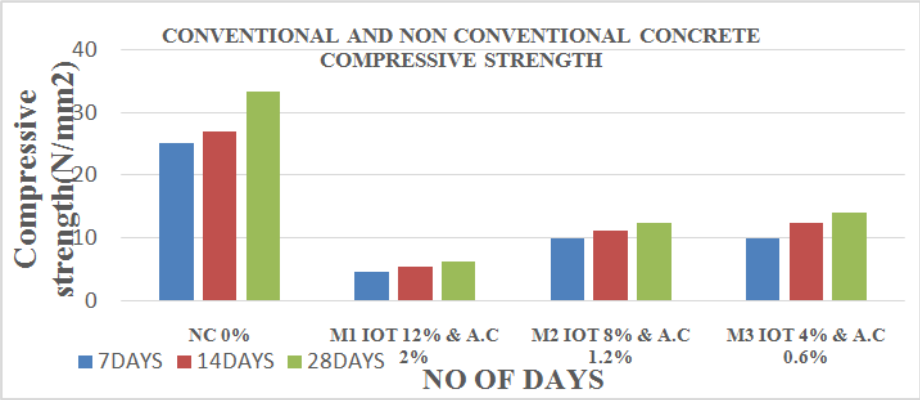
P= max.load in N

A=c/s area in $mm^2$

| Sl.No. | %IOT | %Areca | Compressive strength (Mpa) | | |
|---|---|---|---|---|---|
| | | | 7days | 14 days | 28 Days |
| 1 | 0 | 0 | 25.1 | 27 | 33.2 |
| 2 | 12 | 2 | 4.7 | 5.6 | 6.3 |
| 3 | 8 | 1.2 | 9.9 | 11.2 | 12.5 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 4 | 0.6 | 10 | 12.5 | 14.1 |

***Fig.Table-Compressive strength***




**SPLIT TENSILE STRENGTH TEST**

Specimen of size 150mm diameters and 300mm length were tested. The test was conducted on the compressive testing machine. Cylinder specimen were placed under the compression testing machine in a horizontal direction perpendicular to the direction in which they were casted.

It is found by using equation

$F=2P/IILd$ in $N/mm^2$

Where,

P=Maximum load applied

d= measured depth of specimen

L=length of specimen

L=length of specimen

| Sl.No. | %IOT | %Areca | Compressive strength (Mpa) | | |
|---|---|---|---|---|---|
| | | | 7days | 14 days | 28 Days |
| 1 | 0 | 0 | 25.1 | 27 | 33.2 |
| 2 | 12 | 0.6 | 0.4 | 0.4 | 0.7 |
| 3 | 8 | 1.2 | 1.3 | 2.1 | 2.1 |
| 4 | 4 | 2 | 2.1 | 2.3 | 2.5 |

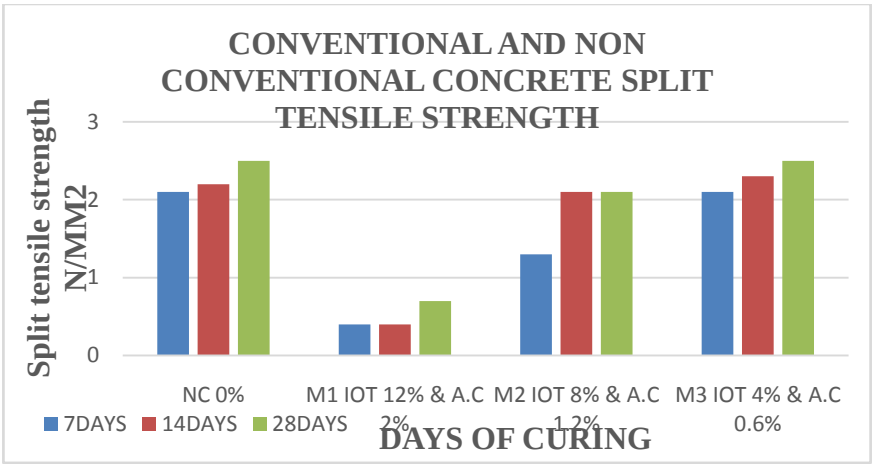



***Fig.Table- Split Tensile Strength***

## IV. CONCLUSION

Based on the comparison of the results from journals work carried out in concrete incorporating IOT is following may be expected.

- Incorporating the IOT with concrete increased in the water demand and decreased the slump. This is believed to be influenced by the surface area and rough texture of the tailings, hence the workability of concrete containing IOT decreased as % of IOT increases.
- Replacement of 4%IOT and addition of 0.6% areca fibers gives best result for compressive strength.
- As percentage of IOT and areca fibers increases more than 12% and 2% the compressive strength of concrete decreases.
- IOT could be used in concrete with sand replacement which would minimize environmental problem and cost.
- Iron ore tailings as a replacement to the sand will solve two problems with one effort, namely elimination of solid waste problem on one hand and provision of a needed construction material on other hand. The iron ore tailings reduces the cost production of concrete.

## REFERENCES

[1]. ShivamTiwari et al., "Effect of Partial Replacement of Sand by Iron Ore Tailings on the Compressive Strength of Concrete", volume no-7, Dec-2017.
[2]. T. T Ugama S. P. Amartey "Effect of Iron Ore Tailing on the Properties of Concrete ", Vol.6,No.10, 2014.
[3]. ManjunathItagi, B. P. Annapurna. "Evaluation of Strength Properties of Hybrid fibre Reinforced Concrete", Volume-8 Issue-8, June, 2019.
[4]. Zhong-xi Tian et al., "Experimental Study on the Properties of Concrete Mixed with Iron Ore Tailings", Volume 2016, Article ID 8606505.
[5]. Aishwarya G, Dinesh T et al., "Study of strength of concrete using areca fibre and title powder as additives", Volume: 06 Issue: 04 Apr 2019.
[6]. Anil Kumar, Anoopkishan k, Divakar L, Sudheer "Study of Compressive Strength of Concrete Using Areca Fibres as Reinforcement", Volume-24 Number 3-June 2015.
[7]. S. Jothibasu, Dr.S.Mohanamurugun "Areca fibre Based Composites-A Perspective Review", Vol. 3, Special Issue 1, February 2017.
[8]. Ananthayya M.B. Prema Kumar W. P. "International Journal of Civil Engineering and Technology (IJCIET)", Volume5, Issue 3, pp. 117-123 March (2014). the Properties of Concrete Mixed with Iron Ore Tailings", Volume 2016, Article ID 8606505.
[9]. Aishwarya G, Dinesh T et al., "Study of strength of concrete using areca fibre and title powder as additives", Volume: 06 Issue: 04 Apr 2019.
[10]. Anil Kumar, Anoopkishan k, Divakar L, Sudheer "Study of Compressive Strength of Concrete Using Areca Fibres as Reinforcement", Volume-24 Number 3-June
[11]. S. Jothibasu, Dr.S.Mohanamurugun "Areca fibre Based Composites-A Perspective Review", Vol. 3, Special Issue 1, February 2017.
[12]. Ananthayya M.B. Prema Kumar W. P. "International Journal of Civil Engineering and Technology (IJCIET)", Volume5, Issue 3, pp. 117-