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ASTUDY ON STRENGTH PROPERTIES OF CONCRETE BY PARTIALLY REPLACEMENT OF FLY ASH AND ROBO SAND

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ABSTRACT:- The Ordinary Portland Cement (OPC) which is widely used materials not consumes significant amount of natural resource energy but also pollute the effective Environment.So in this project we replace the Fly-Ash to the cement and robo sand to the fine aggregate by variable percentages. Fly ash is the by-product of the combustion of pulverized coal in electric power generation plants. Fly ash particles are minute solid spheres. Fly ash is collected from the exhaust gases by electrostatic precipitators or bag filters Color generally ranges from dark grey to yellowish tan for fly ash used for concrete. Chemical makeup of fly ash is primarily silicate glass containing silica, alumina, iron, calcium. The perfect substitute for river sand is robo sand River sand is one of the basic ingredients in manufacture of concrete.

River sand has become expensive and scarce. Therefore looking alternate to the river sand. The crusher dust is known as Robo sand can be used as alternative material to the river sand. Robo sand possess similar properties as that of river sand, hence accepted as a building material. all replacements were done to the M30 grade of concrete. The cement has been replaced by fly ash accordingly in the percentage, and fine aggregate has been replaced by robo sand in percentage.

In this present investigation workability and strength of concrete was evaluated by replacement of Fly Ash and Robo Sand in properties of 0%,20%,40%,60%,80%,100% is suited for M30 and M40 grades of concrete cubes and cylinders were casted at the age of 7,14 and 28 days. In this present experimental study on concrete having grades of M30 and M40 are prepared by the replacement of Fly Ash and natural sand by Robo Sand. Concrete specimens were tested for evaluation of compressive strength and split-tensile strength.

KEYWORDS: Cement, Fine Aggregates, Coarse Aggregates, Fly Ash, Robo Sand and Strength

I.NTRODUCTION

Now- a-days the cost of concrete is increased since the cost of Cement is increased. To reduce the requirements and cost of concrete some alternative materials are needed to replace the Cement.
Accordingly, replacement of cement by fly ash reduces the unit cost of the concrete and conserves energy. The main objective of the present work is to improve the strength of concreted by partial replacement of cement with fly ash is 0%, 20%,40%, 60%, 80% and 100%.Fly ash also has high fineness, which decreases the porosity and pore size and increases the compressive strength. Fly ash is the most widely used pozzolanic material in all over the world. Concrete is the most widely used construction material in civil engineering industry because of its high structural strength, stability, and malleability.
River sand has become expensive and scarce. Therefore looking alternate to the river sand. The crusher dust is known as Robo sand can be used as alternative material to the river sand. Robo sand possess similar properties as that of river sand, hence accepted as a building material. all replacements were done to the M30 grade of concrete. The cement has been replaced by fly ash accordingly in the percentage, and fine aggregate has been replaced by robo sand in percentage.

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Due to digging of river bed, affects the ground water level. In order to fulfil the requirement of fine aggregate, some alternative material must be used. The cheapest and the easiest way of getting substitution for natural sand is obtained mostly from crushing of granite is known as manufactured sand.

1. LITERATURE REVIEW

VANKAYALAPATIRAGHU(2018)
The geo-polymer concrete is produced by using alkaline activated fly ash as binder material instead of cement. Geo-polymer concrete attains good strength and looks as similar as conventional concrete. Utilizing the coarse aggregate which is recycled from construction and demolition(C&D) waste, which reflects in the environment and economic benefit. The residue quarry fines less than 4.75mm obtained from the crushed quarry rock often termed Quarry dust or Quarry stone dust (QSD) and replacing the natural fine aggregate (NFA) by proportions 0%,20%,40%,60%,80% and 100%.From the overview of previous papers literature, the geo-polymer concrete is not having any proper mix design procedures, Therefore the trail and error method adopted. In this research work the alkaline solution used as Sodium hydroxide (NaOH) and Sodium silicate (Na2SiO3) At present attempt is made to discuss the properties of geo-polymer concrete which are prepared by replacing Natural coarse aggregate with 40%, Recycled coarse aggregate (RCA).

Dr CH. RAVI and Dr N.K. AMUDHAVALLI(2018)
The use of high performance concrete offers advantages in durability, ease of placement, and reduced creep and shrinkage, as well as increased compressive, shear and tensile strength. Offsetting these advantages are potentially reduced ductility and fire resistance, and increased unit cost. The present paper focuses on the investigating characteristics of M50 grade concrete with partial replacement of cement with Ground Granulated Blast Furnace Slag (GGBS) and sand with the ROBO sand (crusher dust). The cubes and cylinders are tested for compressive strengths and split tensile strength. It is found that by the partial replacements of cement with GGB Sand the sand with ROBO sand helped in improving the strength of the concrete substantially compared to nominal mix concrete. The compressive strength is studied at 7days, 28 days. Water reducing admixtures are used to increase the workability characteristics. For all levels of cement replacement concrete achieved superior performance in the fresh and mechanical tests should be compared with the reference mixture.

V. RAHUL(2017)
One of the major environmental concerns is the disposal of the waste materials and utilization of industrial by products. Many power plants and electro static precipitators will produce millions of tons waste powder every year. Having considerable high degree of fineness in comparison to cement this material may be utilized as a partial replacement to cement. For this purpose an experiment is conducted to investigate the possibility of using fly ash powder in the production of SCC with combined use SILICAFUME and how it affects the fresh and mechanical properties of SCC. First SCC is made by replacing cement with SILICAFUME in 10% and fly ash powder is blended to mix in percentage like 25% as a partial replacement to cement. Here we use manufacture sand as fine aggregate. By taking fineness modulus 2.5,2.7,2.9 .Test results shows that the SCC mix with combination of 10% SILICAFUME and 25% fly ash powder with fineness modulus 2.7 satisfies filling ability and passing ability and hardened properties are also in the limits prescribed by the EFNARC.

M.MANOJPRAVARLY(2017)
River sand is the one of the basic material in the manufacture of concrete. High Performance Concrete(HPC) is a concrete meeting special combinations of performance and uniformity requirements that cannot be always achieved routinely by using conventional constituents and normal mixing. Recently natural sand is be coming very costly because of its demand in the construction industry and ban of sand mining in rivers. So research for the alternatives of natural sand is going to find in economical way to meet the high performance characteristics. In this path,the manufactured sand called ROBOSAND is the new material i.e., arrived in the world of concrete to fulfil the requirements of Natural sand. The other material FLYASH comes from the industries as a by-product which is freely available. Many researches suggesting that the Fly ash is a good replacement for cement. Codes such as ACI are also suggesting that fly ash will be useful material to replacement up to 35%.This present paper mainly focuses on achieving high performance characteristics of concrete by comparing M80 and M90 grades. The strength, workability and Durability properties for both grades are compared by varying the percentages of ROBOSAND with natural sand by 0%,25%,50%,75% and 100% together with fly ash of 20% replacement in cement. The compressive strength, split tensile strength and flexural strength are compared for both grades and results are tabulated and the optimum percentages are concluded.

YAJURVED REDDY M(2015)
In the present investigation workability, strength and durability of concrete with manufactured sand as replacement to natural sand in proportions of 0%, 20%, 40%, 60% and 100% is studied. The experiments were conducted on M20 and M30 concrete grade with 450 specimens. Slump cone, compaction factor and Vee-bee time tests were conducted to determine workability. Results showed that as replacement of natural sand by manufactured sand is increased, there is a decrease in the workability. Compressive strength, split tensile strength and flexural strength tests were conducted to determine strength of concrete. The 60% replacement showed an increase in strength of about 20% and other replacements to an order of minimum 0.93% in both the grades. The durability study is conducted by treating specimens for 30 days with 5% concentrated Hydro-Chloric Acid and the concrete mix with 60% replacement has given good durable properties.

2. MATERIALS USED

Fly ash

Class F fly ash is collected in Vijayawada Thermal Power Station. Class F fly ashes with calcium oxide (CaO) content less than 6%, contains as low calcium ashes, are not self hardening but generally exhibit pozzolanic properties. These ashes contain more than 2% unburned carbon determined by loss on ignition (LOI).

Fine aggregates

The locally available river sand, passing through 4.75 mm was used in this experimental work. The properties of fine aggregates were determined as per IS: 2386-1963

Coarse aggregates

Locally available crushed granite stone aggregate of 10mm size was used as coarse aggregate. The coarse aggregate passing through 10mm and retaining 4.75mm was used for experimental work. The properties of coarse aggregates were determined as per IS: 2386- 1963

Robo sand

Crushed rock aggregate quarrying generates considerable volumes of quarry fines, often termed “quarry dust”. Quarry dust can be defined as waste material after the extraction and processing of rocks to form fine particles less than 4.75mm.

3. EXPERIMENTAL INVESTIGATION

Manufacture of Fresh Concrete and Casting

Concrete can be manufactured by adopting the techniques used in the manufacture of Portland cement concrete. In the laboratory, the fly ash and the aggregates were first mixed together for 3 minutes. The fresh concrete was cast into the moulds immediately after mixing, in three layers for cubical specimens of size 150mm x 150mm x 150mm , Beams of size 500mm×100mm×100mm and cylindrical moulds of size 150mm diameter and 300mm height. For compaction of the specimens, each layer have rodded with 60 strokes.

Mixing of concrete

Curing of concrete

Ambient curing substantially assists the chemical reaction that occurs in the geopolymer paste. The curing time varied from 12 to 24 hours. Longer curing time improved the polymerization process resulting in higher compressive strength. The rate of increase in strength was rapid up to 24 hours of curing time and beyond 24 hours, the gain in strength was only moderate. Higher curing temperature of geopolymer concrete increases compressive strength. Ambient curing is called as weather curing i.e, Room temperature

Tests to be conducted on concrete

Workability of concrete

Compressive strength concrete

Split tensile strength concrete

4. RESULTS AND ANALYSIS

Workability : Slump cone test

Table 1:- Slump values of M30

MIX	Proportions	Slump Values(mm)
M1	100%C+0%F+100%FA +0%RS	92
M2	80%C+20%F+80%FA +20%RS	88
M3	60%C+40%F+60%FA +40%RS	74
M4	40%C+60%F+40%FA +60%RS	66
M5	20%C+80%F+20%FA +80%RS	54
M6	0%C+100%F+0%FA +100%RS	51

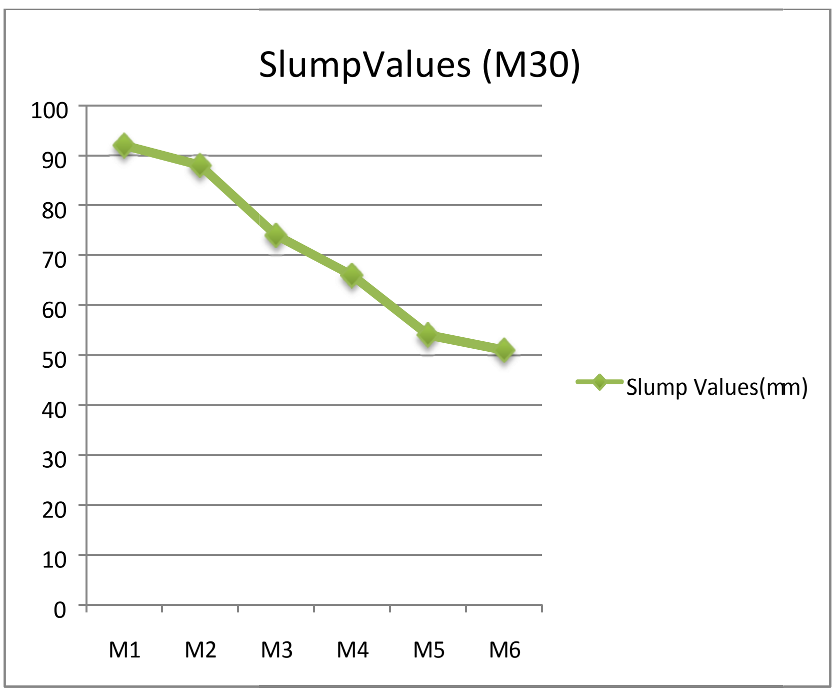

Fig 1:- Graphical representation of variation of Slump values for M30 with various percentages of replacement of fly ash and robo sand

Table 2:- Slump values of M40

MIX	Proportions	Slump Values(mm)

M1	100%C+0%F+100%FA+0%RS	96
M2	80%C+20%F+80%FA +20%RS	92
M3	60%C+40%F+60%FA +40%RS	87
M4	40%C+60%F+40%FA +60%RS	76
M5	20%C+80%F+20%FA +80%RS	72
M6	0%C+100%F+0%FA +100%RS	68

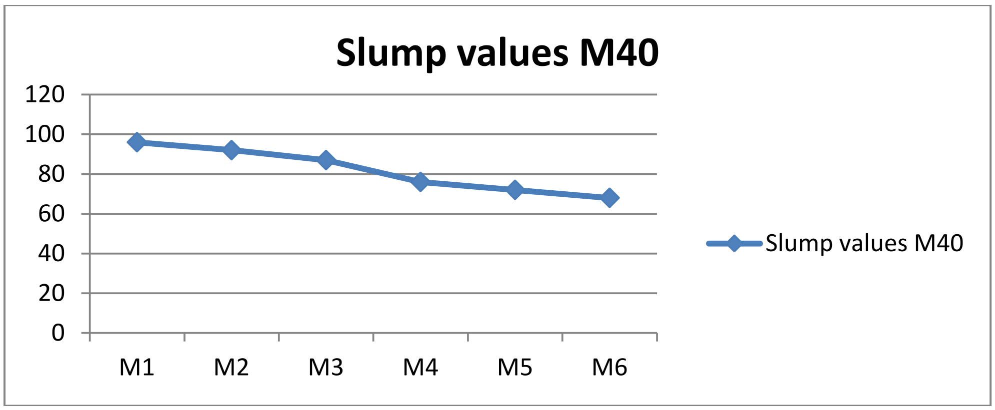

Fig2:- Graphical representation of variation of Slump values for M40 with various percentages of replacement of fly ash and robo sand

Table 3:- compaction factor values for M30

MIX	Proportions	Compaction Factor Values
M1	100%C+0%F+100%FA +0%RS	0.86
M2	80%C+20%F+80%FA +20%RS	0.88
M3	60%C+40%F+60%FA +40%RS	0.92
M4	40%C+60%F+40%FA +60%RS	0.84
M5	20%C+80%F+20%FA +80%RS	0.78
M6	0%C+100%F+0%FA +100%RS	0.74

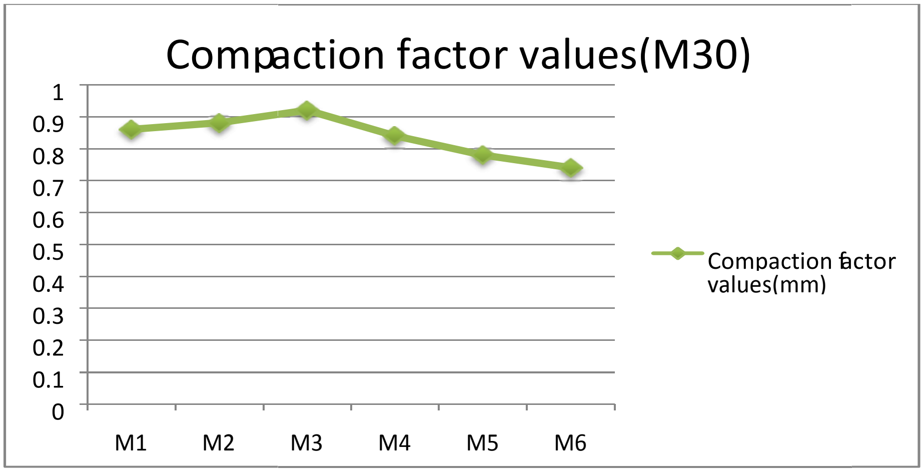

Fig 3:- Graphical representation of variation of compaction factor values for M30 with various percentages of replacement of fly ash and robo sand

Table 4:- compaction factor values for M40

MIX	Proportions	Compaction Factor Values
M1	100%C+0%F+0%RS+100%FA	0.92
M2	80%C+20%F+20%RS+80%FA	0.84
M3	60%C+40%F+40%RS+60%FA	0.91
M4	40%C+60%F+60%RS+40%FA	0.81
M5	20%C+80%F+80%RS+20%FA	0.76
M6	0%C+100%F+100%RS+0%FA	0.73

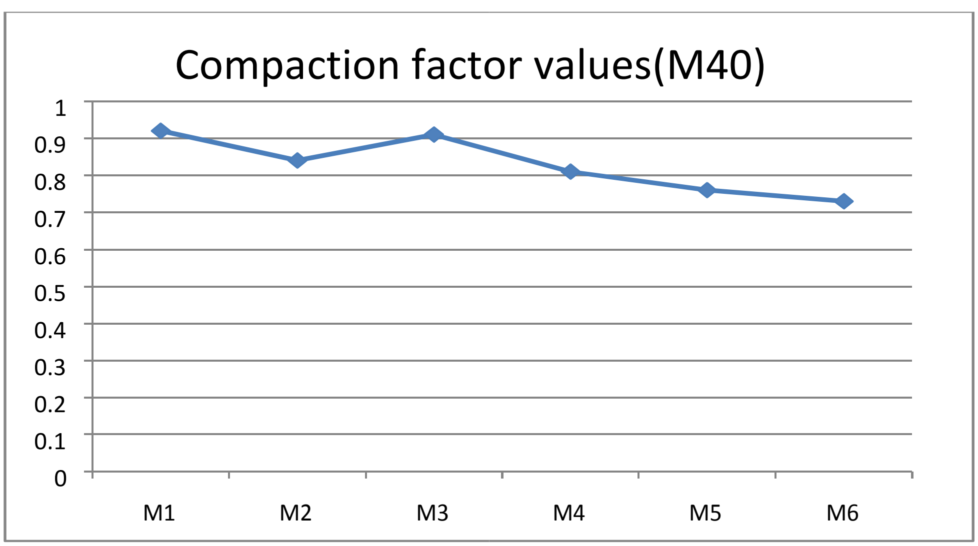

Fig 4:- Graphical representation of variation of compaction factor values for M40 With various percentages of replacement of fly ash and robo sand

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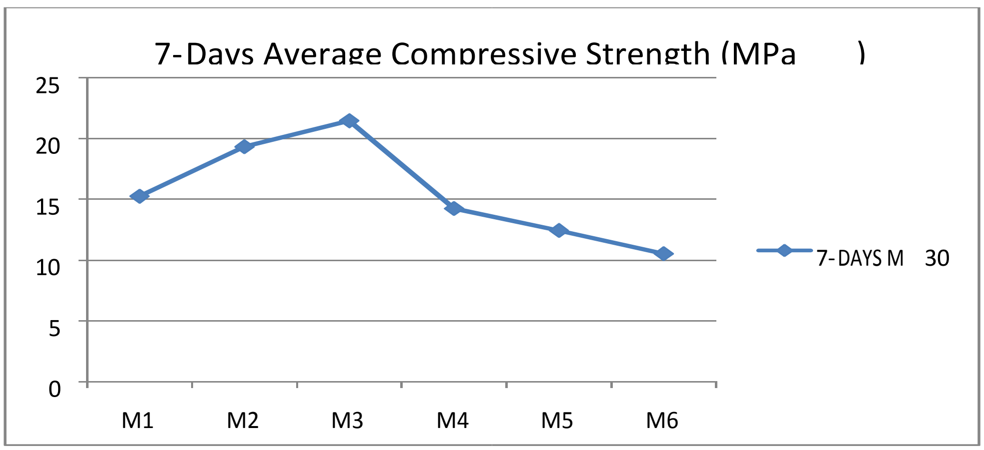
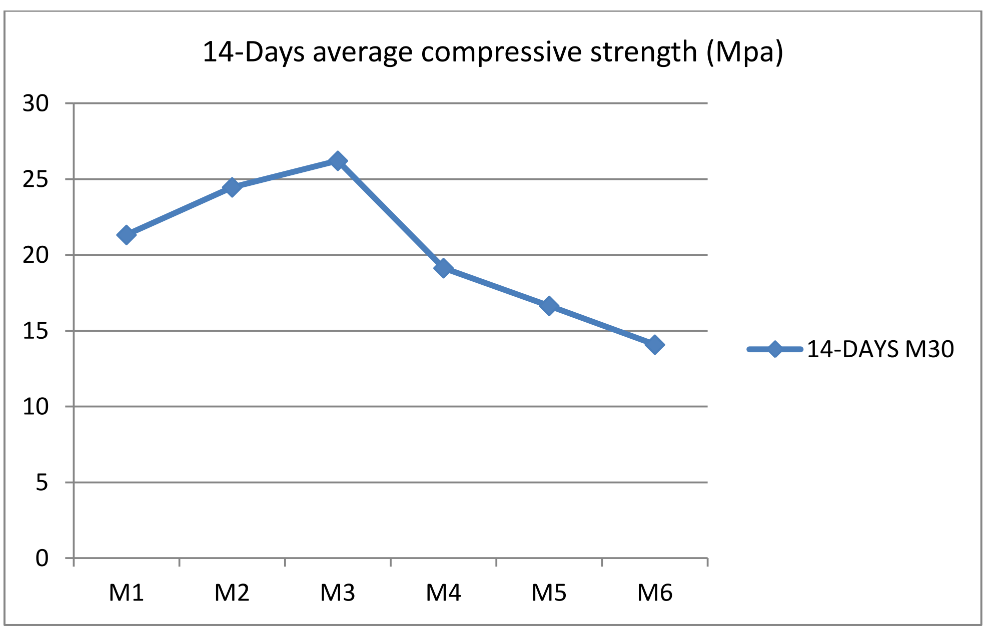
Compressive strength

Table 5: -Compressive strength test values for M30

Mix	Proportions	7 days (MPa)	14 days (MPa)	28 days (MPa)
M1	100%C+0%F+100%FA+0%RS	15.25	21.32	27.14
M2	80%C+20%F+80%FA+20%RS	19.32	24.46	30.62
M3	60%C+40%F+60%FA+40%RS	21.46	26.21	34.45
M4	40%C+60%F+40%FA+60%RS	14.23	19.13	26.63
M5	20%C+80%F+20%FA+80%RS	12.43	16.64	22.12
M6	0%C+100%F+0%FA+100%RS	10.52	14.08	20.21





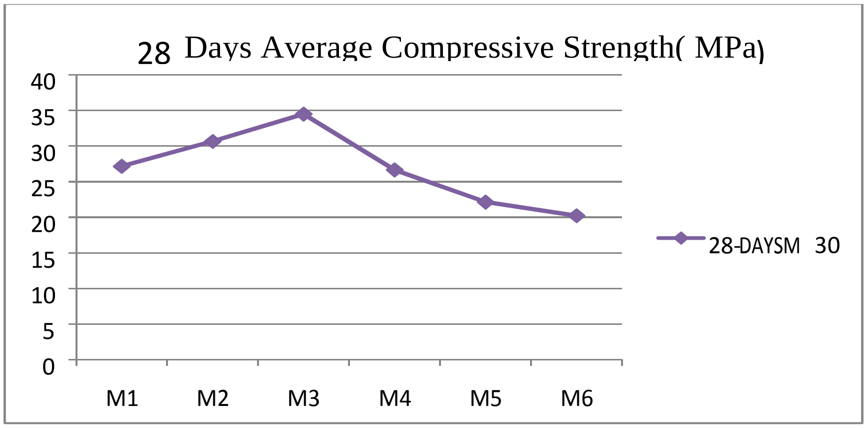


Fig 5,6&7:- Graphical representation of variation of Compressive strength values for M30 with various percentages of replacement of cement by fly ash and robo sand

Table 6: -Compressive strength test values for M40

Mix	Proportions	7 days(MPa)	14days(MPa)	28days(MPa)
M1	100%C+0%F+100%FA+0%RS	19.41	19.41	37.82
M2	80%C+20%F+80%FA+20%RS	24.4	24.4	40.12
M3	60%C+40%F+60%FA+40%RS	28.42	28.42	41.64
M4	40%C+60%F+40%FA+60%RS	22.12	22.12	32.41
M5	20%C+80%F+20%FA+80%RS	20.52	20.52	30.12
M6	0%C+100%F+0%FA+100%RS	18.65	18.65	28.62

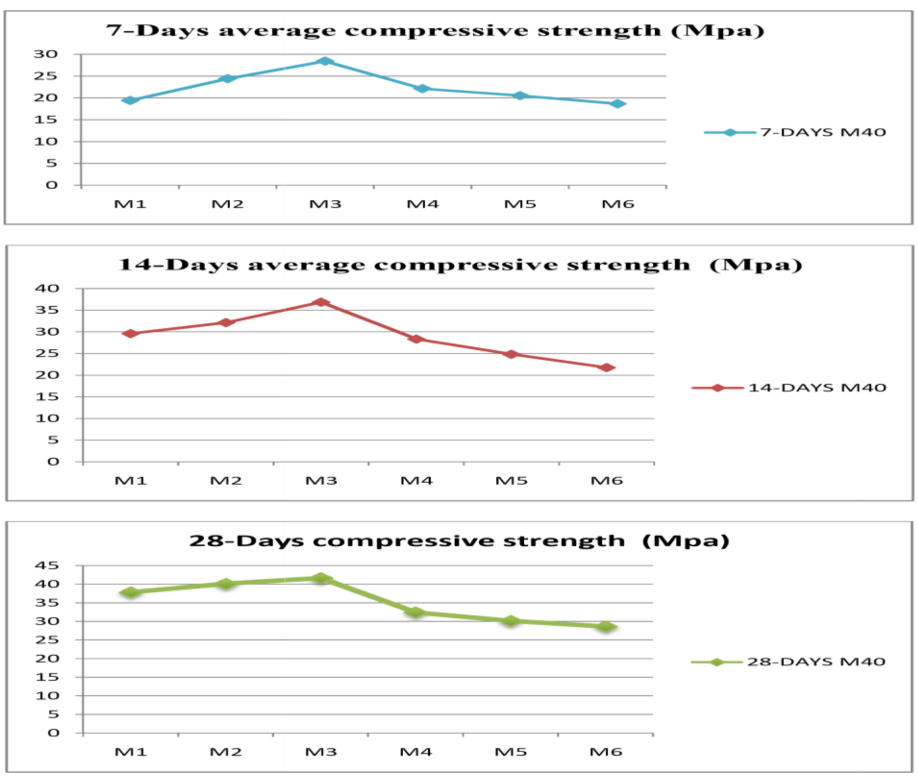
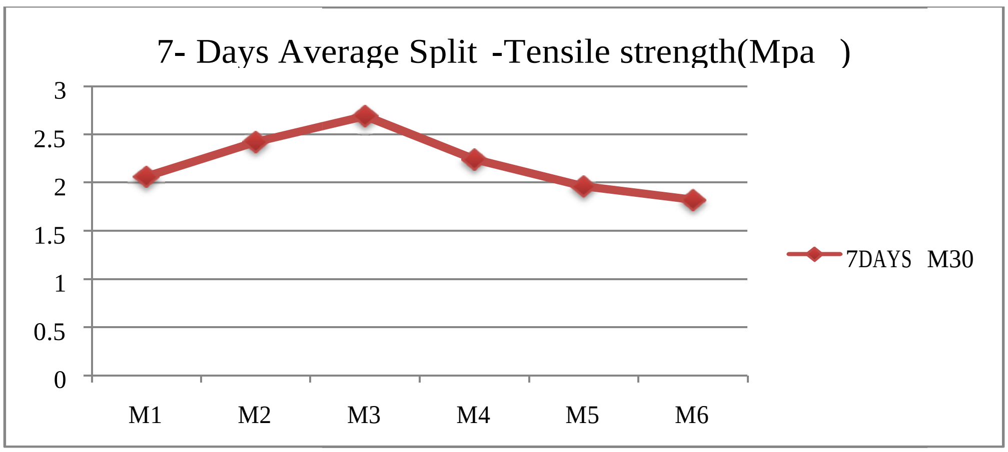


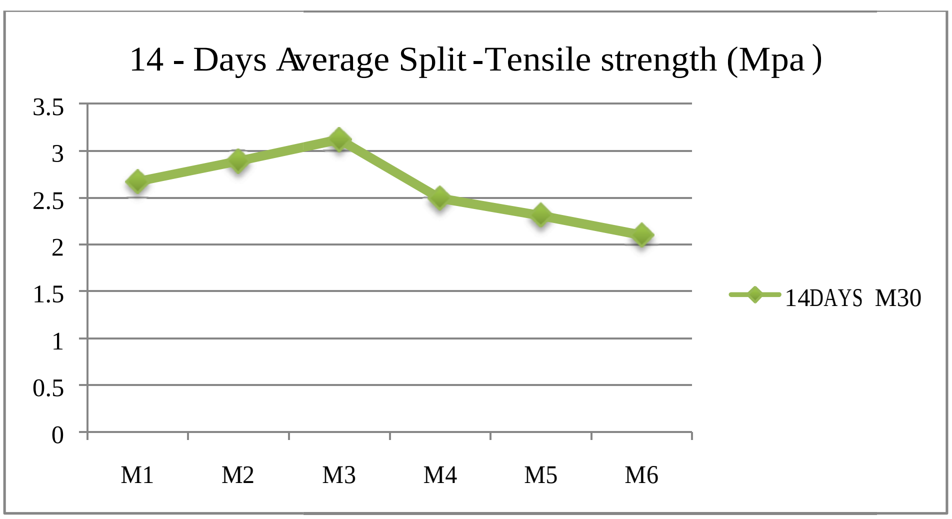
Fig 8,9&10:- Graphical representation of variation of Compressive strength values for M40 with various percentagesof replacement of cement by fly ash and robo sand

Split tensile strength

Table 7: -Split-ten sile strength test values for M30

Mix	Proportions	7 days (MPa)	14 days (MPa)	28 days (MPa)
M1	100%C+0%F+100%FA+0%RS	2.06	2.67	3.15
M2	80%C+20%F+80%FA+20%RS	2.42	2.89	3.45
M3	60%C+40%F+60%FA+40%RS	2.69	3.12	3.84
M4	40%C+60%F+40%FA+60%RS	2.24	2.49	3.28
M5	20%C+80%F+20%FA+80%RS	1.96	2.31	3.16
M6	0%C+100%F+0%FA+100%RS	1.82	2.1	2.46





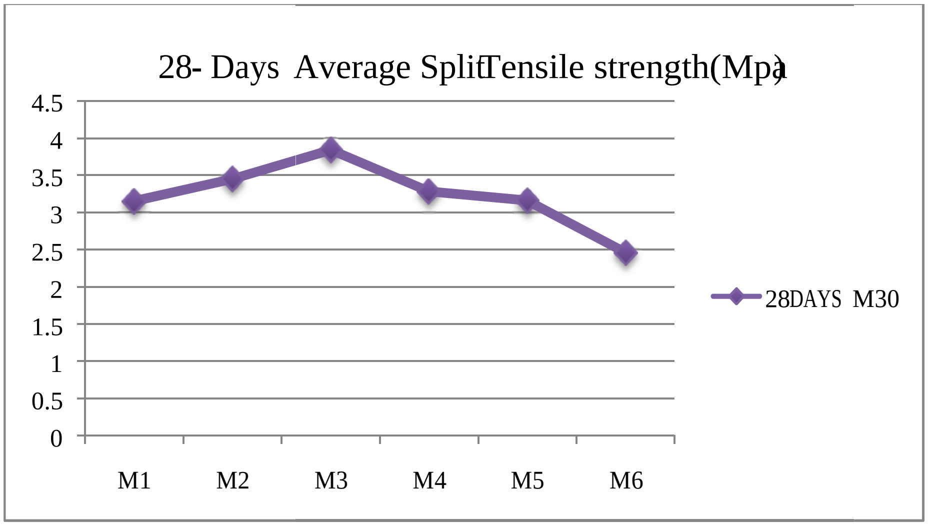
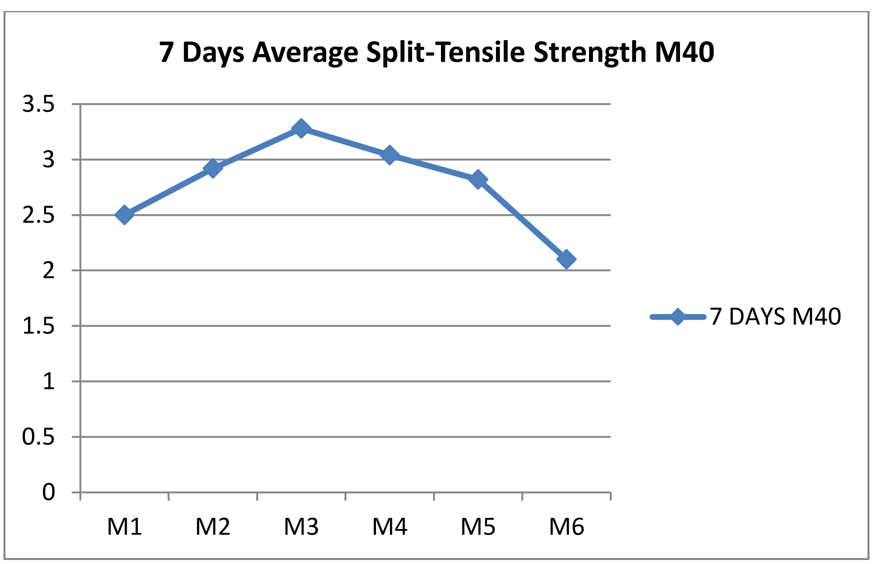
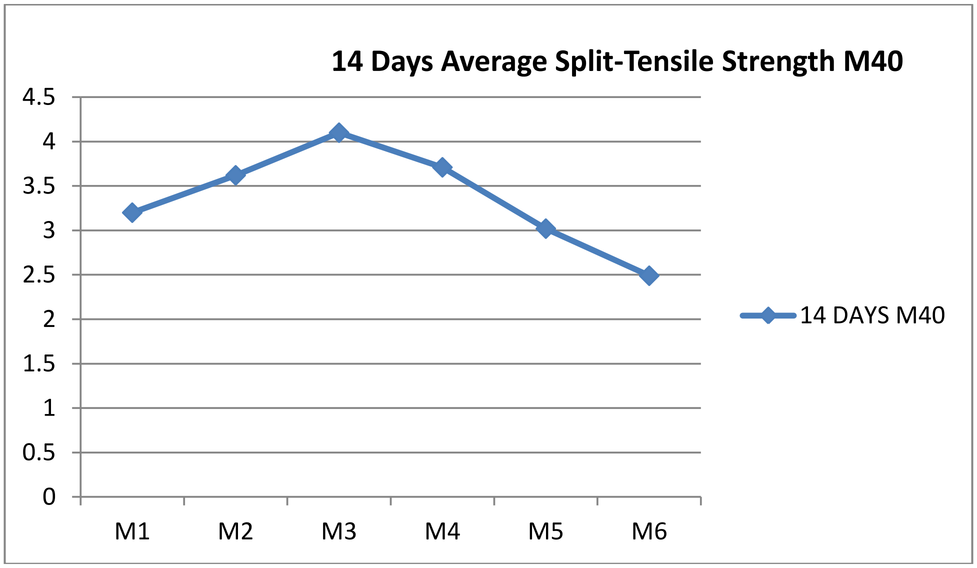


Fig 11,12&13:- Graphical representation of variation of Split Tensile strength values for M30 with various percentages of replacement of cement by fly ash and robo sand

Table 8: -Split-tensile strength test values for M40

Mix	proportions	7 days (MPa)	14 days (MPa)	28 days (MPa)
M1	100%C+0%F+100%FA+0%RS	2.5	3.2	3.64
M2	80%C+20%F+80%FA+20%RS	2.92	3.62	4.16
M3	60%C+40%F+60%FA+40%RS	3.28	4.1	4.82
M4	40%C+60%F+40%FA+60%RS	3.04	3.71	2.83
M5	20%C+80%F+20%FA+80%RS	2.82	3.02	2.41
M6	0%C+100%F+0%FA+100%RS	2.1	2.49	2.12





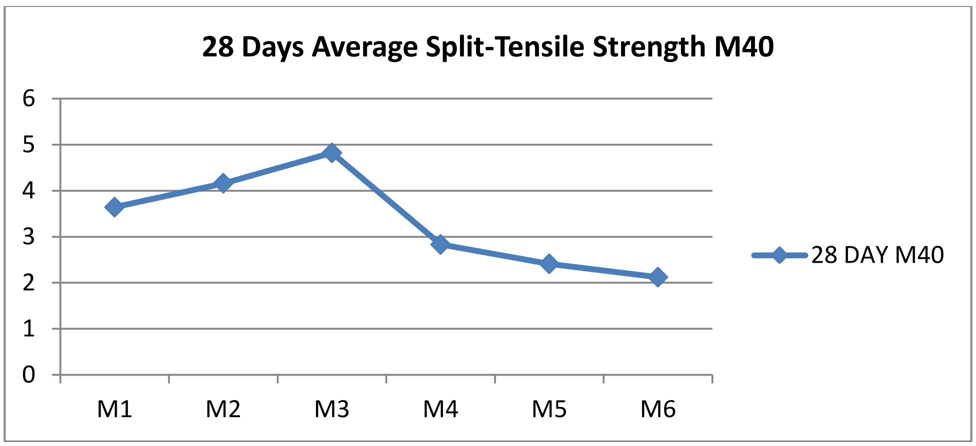


Fig 14,15&16:- Graphical representation of variation of Split Tensile strength values for M40 with various percentages of replacement of cement by fly ash and robo sand

CONCLUSIONS

1. From this study of M30 and M40 grades of concrete tends to no significant physical change in its properties at natural curing is observed.
2. The value of slump increase from 74 mm of the higher value of the slump is observed at M3 mix (60%C+40%F+60%FA +40%RS) for M30.
3. The value of slump increase from 87mm of the higher value of the slump is observed at M3 mix (60%C+40%F+60%FA +40%RS) for M40.
4. The value of compaction factor increases from 0.92 of the higher value compaction factor is observed at M3 mix (60%C+40%F+60%FA +40%RS) for M30.
5. The value of compaction factor increases from 0.91 of the higher value compaction factor is observed at M3 mix (60%C+40%F+60%FA +40%RS) for M40.
6. The optimum value (maximum value) of compressive strength 34.45 MPa was observed at M3 mix (60%C+40%F+60%FA+40%RS) for 7 ,14 and 28 days of curing M30 grade of concrete.
7. The optimum value (maximum value) of compressive strength 41.64 MPa was observed at M3 mix (60%C+40%F+60%FA+40%RS) for 7, 14 and 28 days of curing M40 grade of concrete.
8. The optimum value (maximum value) split-tensile test 3.84 MPa was observed at M3 mix (60%C+40%F+60%FA +40%RS) for 7, 14, and 28 days of curing for M30 grade of concrete.
9. The optimum value (maximum value) split-tensile test 4.82 MPa was observed at M3 mix (60%C+40%F+60%FA +40%RS) for 7,14, and 28 days of curing for M40 grade of concrete.

10. The construction industry is in demand of Eco-friendly and green materials which are durable at compact to the casting concrete materials fly-ash is a advantage but it used as tested against strength and durability confirmed.

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