EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES OF LIGHTWEIGHT AGGREGATE CONCRETE

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Abstract: Lightweight cement can be characterized as a kind of solid which incorporates an Expanding specialist in it that builds the volume of the blend while lessening the dead weight. It is lighter than the traditional concrete with a dry thickness of 300 kg/m3 up to 1840 kg/m3. The fundamental strengths of lightweight concrete are its low thickness and low warm conductivity. Lightweight concrete (LWC), with its decreased weight and enhanced sturdiness, empowers longer traverses, less wharfs, and life span for connect structures. The utilization of basic level light weight concrete diminishes the self-weight and develops bigger precast units. In this investigation, an endeavor has been made to think about the Mechanical Properties of an auxiliary review light weight concrete M25 utilizing the light weight total pumice stone as an incomplete substitution to coarse total and mineral admixture materials like Fly Ash and Silica Fume. For this reason, alongside a Control Mix, 12 sets were set up to examine the compressive quality, rigidity and flexural quality. Each set includes 4 solid shapes, 2 chambers and 2 crystals. Droop test were done for each blend in the crisp state. 28-days Compressive Strength, Tensile Strength and Flexural Strength tests were performed in the solidified state. The investigation is additionally can be stretched out for mixing of concrete with various sorts of mineral admixtures. It is watched that there is impediment in Compressive quality, split elasticity, Flexural quality and Young's modulus for the light weight total supplanted solid when contrasted with the solid made with ordinary total. For these light weight total,concrete blends when "concrete" was supplanted by 'fly fiery remains' it is seen that there is a negligible change in the properties considered. For 25% supplanted light weight total when concrete was supplanted by 15%, 20%, 25% and 30%fly fiery debris, the most extreme pick up in compressive quality of 32.8% at 28 days is watched for 20% substitution of fly powder. Essentially, the pickup in split rigidity, flexural quality and Young's modulus of Elasticity are 20%, 11.3% and 41.9% is seen at 20% substitution of fly powder individually.

1. INTRODUCTION

1.1 General:

Concrete has been utilized since old circumstances. Customary Roman cement for instance was produced using volcanic powder (pozzolana), and hydrated lime. Roman cement was better than other solid formulas (for instance, those comprising of just sand and lime) utilized by different countries. Other than volcanic fiery debris for making general Roman solid, block tidy can likewise be used. Other than standard Roman concrete, the Romans additionally imagined water powered solid, which they produced using volcanic fiery remains and dirt.Concrete is the most broadly utilized man-made development material. It is acquired by blending bond, water and totals (and occasionally admixtures) in required extents. The blend when set in shapes and. permitted to cure turns out to be hard like stone. The solidifying is caused by concoction activity amongst water and the bond and it proceeds for quite a while, and thus the solid becomes more grounded with age. The solidified concrete may likewise be considered as a manufactured stone in which the voids of bigger particles (coarse total) are filled by the littler particles (fine total) and the voids of fine totals are loaded with bond. In a solid blend, the concrete and water shape a glue called bond water glue which notwithstanding filling the voids of fine total goes about as cover on solidifying, in this way establishing the particles of the totals together in a minimal mass. The quality, sturdiness and different attributes of concrete rely on the properties of its fixings, on the extents of blend, the strategy for compaction and different controls amid putting, compaction and curing.The advances in solid innovation have made ready to make the best utilization of locally accessible materials by prudent blend proportioning and legitimate workmanship, to create concrete fulfilling execution necessities.Solid making is not simply an issue of blending fixings to deliver a plastic mass, however great cement needs to fulfill execution prerequisites in the plastic or green state and furthermore the solidified state. In the plastic express the solid ought to be workable and free from isolation and dying. In its solidified state cement ought to be solid, tough and impermeable; and it ought to have least dimensional changes.

1.2. Special concrete and concreting techniques

Despite its flexibility, bond solid experiences a few disadvantages, for example, low rigidity, porousness to fluids and resulting consumption of support, weakness to concoction assault, and low solidness. Changes have been produced using time to time to conquer lack of bond concrete yet holding the other alluring attributes. Late advancements in the material and development innovation have prompted noteworthy changes bringing about enhanced execution, more extensive and more practical utilize. The changes in execution can be gathered as: Preferred mechanical properties over that of customary concrete, for example, compressive strength, rigidity strength, flexural strength, and so on. Better strength accomplished by methods for expanded compound and stop defrost resistances, Improvements in chose properties of intrigue, for example, impermeability, bond, warm protection, gentility, scraped area and slip resistance, and so forth.

Various special concretes are

1. Lightweight concrete
2. Ultra-lightweight concrete
3. Vacuum Concrete
4. Waste material based concrete
5. Mass concrete
6. Shotcrete or geniting
7. Ferro cement
8. Fiber reinforced concrete
9. Polymer concrete composites (PCCs)
10. Sulphur concrete and Sulphur-infiltrated concrete
11. Jet (Ultra-rapid hardening) cement concrete
12. Gap-graded concrete
13. No-fines concrete

2. LITERATURE REVIEW

2.1 General

A portion of the writing surveys are gathered and they are recorded as beneath. Portrays test examination an endeavor is to be made to consider the quality properties of light weight soot total bond concrete in various rate extents of 0, 25, 50,75 and 100 by volume of light weight total cement can be readied. By utilizing this property, for example, compressive quality, split rigidity, modulus of flexibility, thickness and shear push.

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Reasoned that 60 percent supplanting of ordinary total with soot by volume alongside bond supplanted by 10 percent of silica rage by weight, yields the objective mean quality of M20 concrete. It is worth to be noticed that there is a slight increment in quality and different properties because of broadened curing periods and the unit weight of the ash concrete is changing from 1980Kg/m³ to 2000Kg/m³ with various rates of soot. It is additionally noticed that there is a diminishing in thickness after broadened curing periods

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Has considered the quality and captivity attributes of cement made with ash based lightweight totals. Before this the extent of soot based light weight, total was advanced. The mechanical properties, compressive quality and split elastic qualities were learned toward the finish of 3, 7 and 28 days for mid-range review cements with various sizes of total. It was noticed that with 12.5mm size total and 30% fly fiery remains substitution, the mechanical properties were prevalent in 20Mpa Lightweight Concrete, while 10 mm measure total with a 30% fly ash substitution enhanced the properties of 30Mpa cement

3. METHODS AND MATERIALS

The trial examination comprises of throwing and testing of 9sets alongside control blend. Each set includes 4 solid shapes, 2 barrels and 2 crystals for deciding compressive, ductile and flexural qualities separately. Pumice stone is utilized as a part of the investigation with various rates as an incomplete substitution to regular weight coarse aggregate alongside the fluctuating rates of the distinctive admixtures like Silica Fume and Fly Ash. Solid shape segment measurement is of15cmx15cmx15cm, barrel segment measurement is 15cmx30cm and crystal measurement is 50cmx10cmx10cm. The moldsare connected with an oil before putting the solid. Following a day of throwing, the molds are evacuated. The 3D squares, barrels and crystals are moved to the curing tank precisely.

3.1 Materials:

The constituent materials used in this study are given below:

1. Cement
2. Normal Weight Coarse Aggregate
3. Fine Aggregate
4. Fly Ash
5. Silica Fume
6. Pumice Stone (Light Weight Coarse Aggregate)

Table 3.1: Sieve Analysis of Coarse Aggregate

S.NO	IS Sieve No	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative percentage weight retained	Cumulative percentage weight passing
1	25	0	0	0	100
2	20	1660	1660	33.2	66.8
3	16	2080	3740	74.8	26.2
4	12.5	1035	4775	95.5	4.5
5	10	145	4920	98.4	1.6
6	6.3	40	4960	99.2	0.8
7	4.75	40	5000	100	0
8	Pan	0	5000	100	0

Table 3.2: Sieve Analysis of Fine Aggregate

S.NO	IS Sieve No	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative percentage weight retained	Cumulative percentage weight passing
1	4.75	20	20	2	98
2	2.36	20	40	4	96
3	1.18	180	220	22	78
4	0.	305	525	52.5	47.5
5	0.3	395	920	92	8
6	0.15	70	990	99	1
7	0.075	10	1000	100	0
8	Pan	0	1000	100	0

Table 3.3: The Chemical Composition of Fly Ash

S.NO	OXIDE	FLY ASH
1	SiO_2	18.95
2	Al_2O_3	7.53
3	$Fe_2 O_3$	3.85
4	CaO	51.29
5	MgO	1.58
6	SO_3	12.06
7	K_2O	1.51
8	Na_2O	0.32
9	Loi	1.94

4. TEST RESULTS AND DISCUSSION

4.1 Cube Compressive Strength Of Concrete

For every level of fly fiery debris, 3 block examples have been thrown. In each of the 165 3D shapes of size, 150 mm x 150 mm x 150 mm have been thrown. The block compressive quality of cement at various days for the diverse supplanting of fly ash with the concrete and with 25% light weight aggregate supplanted in coarse aggregate and is appeared in Table 4.1.

Table 4.1: Compressive Strength of Concrete Cube

S.NO	% replacement of fly ash	Compressive Strength(Mpa)				
		3 days	7 days	28 days	90 days	180 days
	0% NA	20	24	34	39.5	40.6
1.	0% Fly Ash 25 % LWA	15.288	16.28	23.2	24.98	25.9
2.	15% Fly Ash 25 % LWA	16.5	17.88	28.2	30.43	31.23
3.	20% Fly Ash 25 % LWA	17.78	19.07	30.5	33.45	34.55

4.	**25% Fly Ash 25 % LWA**	**16.7**	**18**	**28.5**	**30.99**	**31.798**
5.	**30% Fly Ash 25 % LWA**	**16.2**	**17.5**	**28.2**	**30.16**	**31.05**

4.2 Split Tensile Strength:

For every level of fly fiery remains, 3 round and hollow examples have been thrown. In each of the 54 chambers of size 150 mm breadth and 300 mm tallness, have been thrown. In this present examination in view of the Compressive quality outcomes acquired for 25% light weight aggregate with various extents as of fly fiery debris substitution in concrete. It is seen that the greatest compressive quality is gotten for 20% fly fiery remains substitution in concrete. Henceforth the split elastic proposing is contemplated for the blend of 25% light weight aggregate, substitution in coarse aggregate and 20% substitution of fly fiery remains in concrete and are appeared in Table 4.2

Table 4.2: Split Tensile Strength of Concrete Cylinder

S.NO	**% replacement of fly ash**	**Split tensile strength (Mpa)**		
		3 days	**7 days**	**28 days**
1	**0% LWA 0 % Fly Ash**	2.6	1.9	2.2
2	**25% LWA 0% Fly Ash**	1.9	2.1	2.3
3	**25% LWA, 20% Fly Ash**	2.2	2.3	2.8

Modulus Of Elasticity &Flexural Strength

For each percentage of fly ash, 3 beam specimens have been cast. In all 108 beams of size 700 mm x 150 mm x 150 mm, have been cast and the results are shown in table 4.3 and table 4.4.

Table 4.3: Modulus of Elasticity of Concrete

S.NO	**% replacement of fly ash**	**Modulus of elasticity (Mpa)**		
		3 days	**7 days**	**28 days**
1	**0% LWA 0 % Fly Ash**	$2.5X10^4$	$2.6X10^4$	$2.85X10^4$
2	**25% LWA 0%**	$2.35X10^4$	$2.45X10^4$	$2.58X10^4$

	Fly Ash			
3	**25% LWA, 20% Fly Ash**	2.6X10^4	3.45X10^4	3.663X10^4

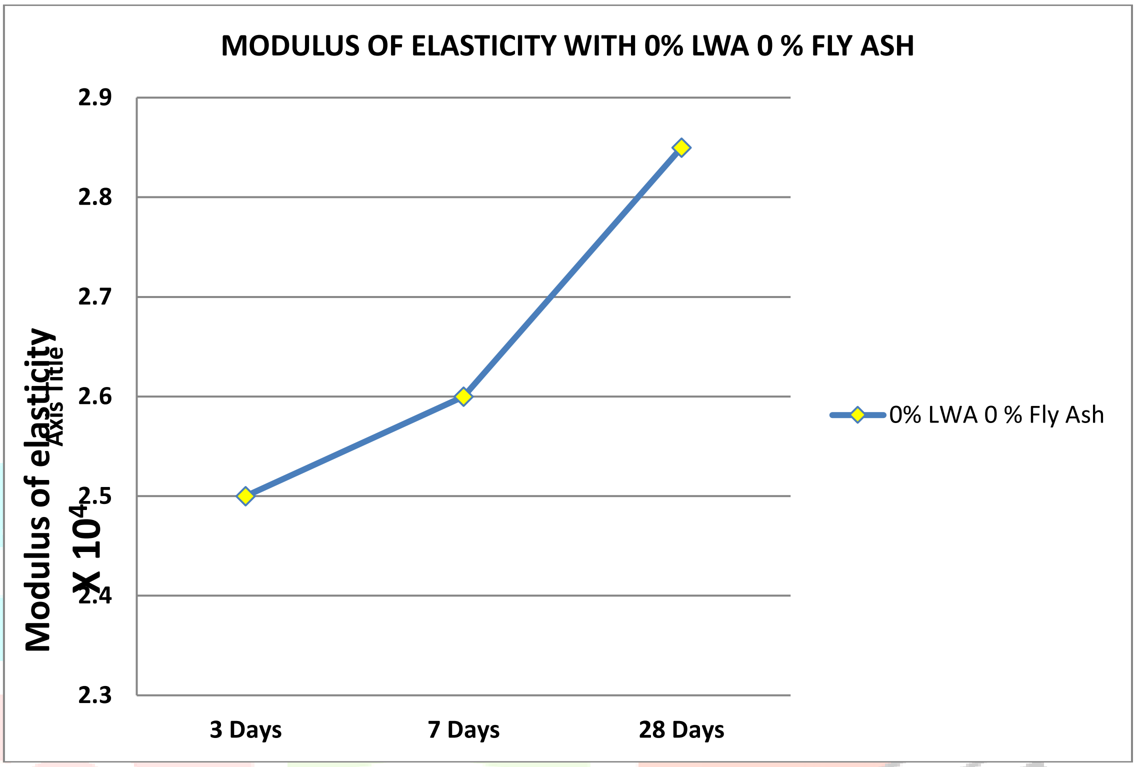

Figure 4.12modulus of elasticity with 0% fly ash and 0% LWA

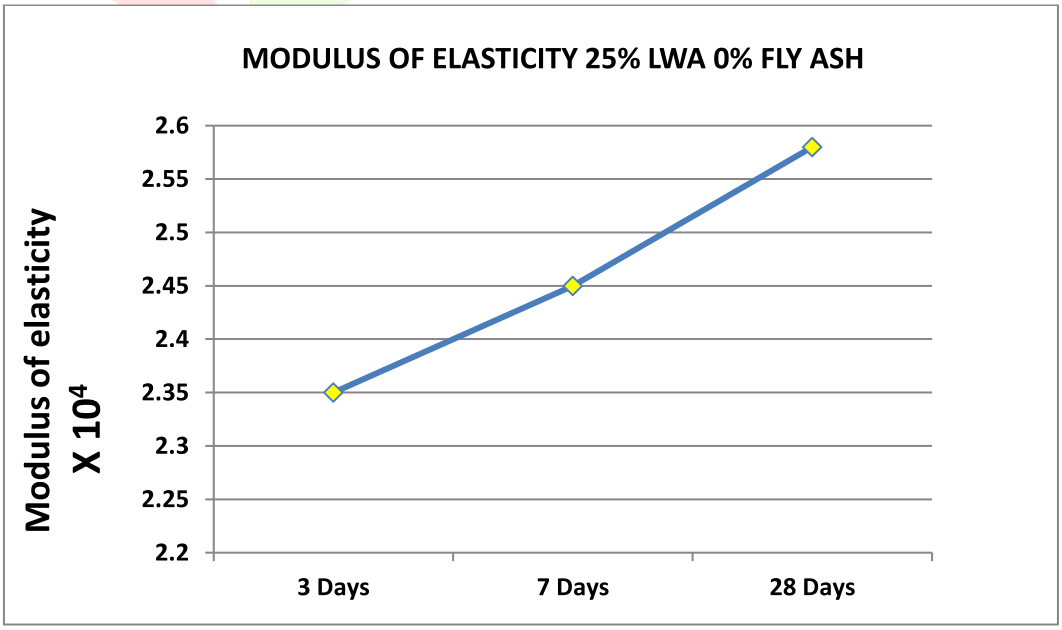

Figure 4.13modulus of elasticity with 25% fly ash and 0% LWA

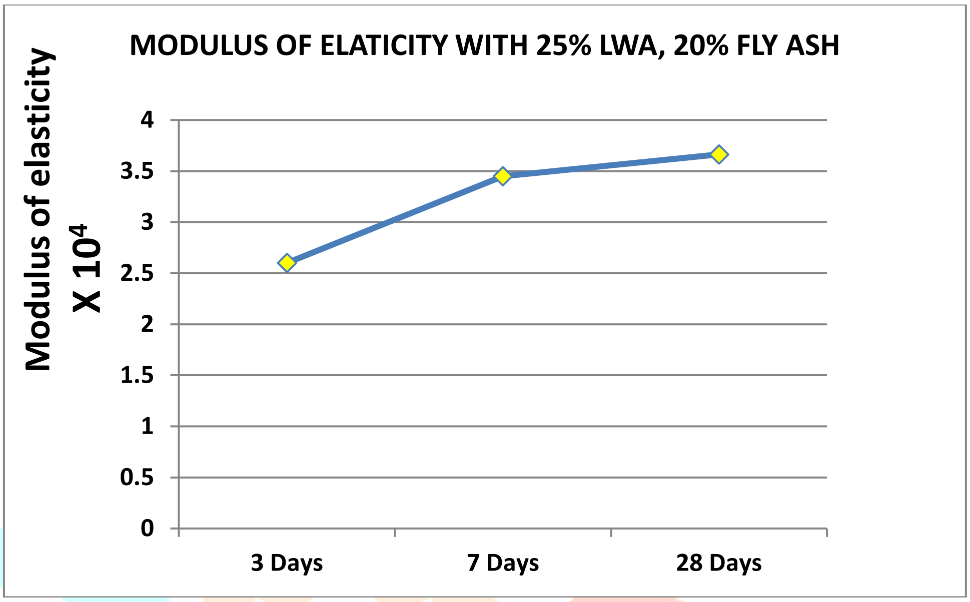

Figure 4.14modulus of elasticity with 25% fly ash and 20% LWA

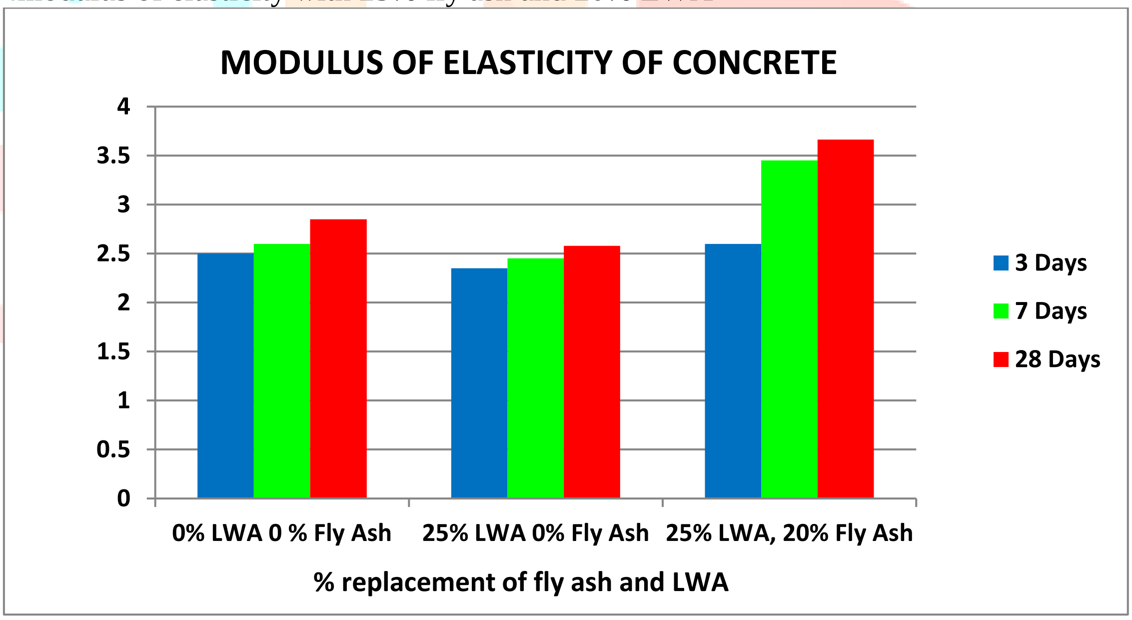

Figure 4.15modulus of elasticity

Figures 4.12 to figure 4.14 shows the graphs individually for different percentage replacements of fly ash and LWA and figure 4.15 shows the combined graph of replacement of fly ash and LWA.

Table 4.4: Flexural Strength of Concrete

S.NO		**% replacement of fly ash**	**Flexural Strength (Mpa)**		
			3 days	**7 days**	**28 days**

1		**0% LWA 0 % Fly Ash**	2.69	2.82	3.72
2		**25% LWA 0% Fly Ash**	2.43	2.6	2.93
3		**25% LWA, 20% Fly Ash**	2.53	2.7	3.26

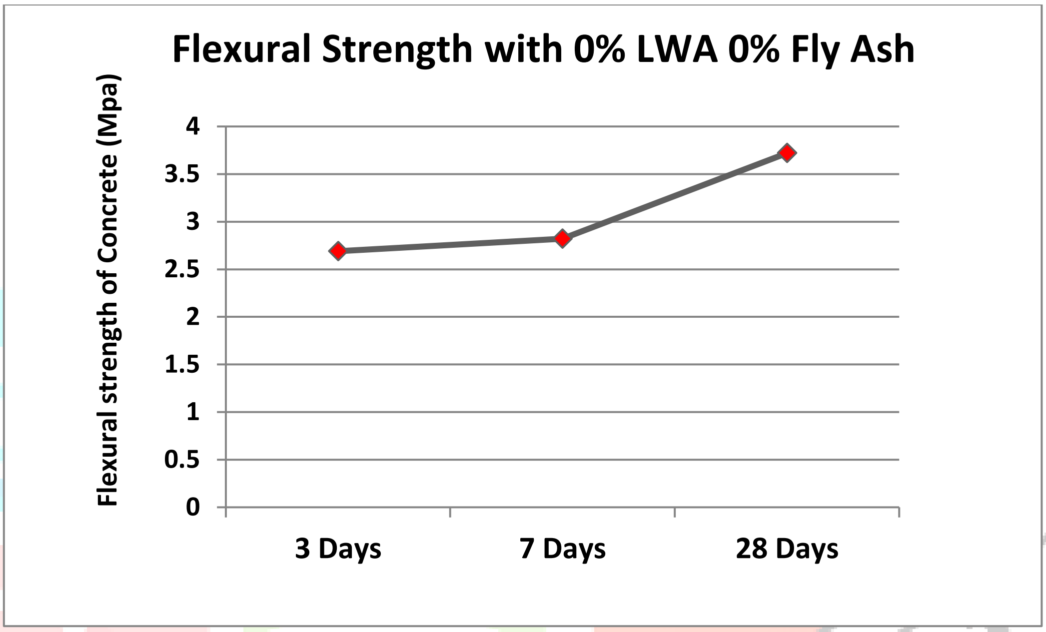

Figure 4.16modulus of elasticity with 0% fly ash and 0% LWA

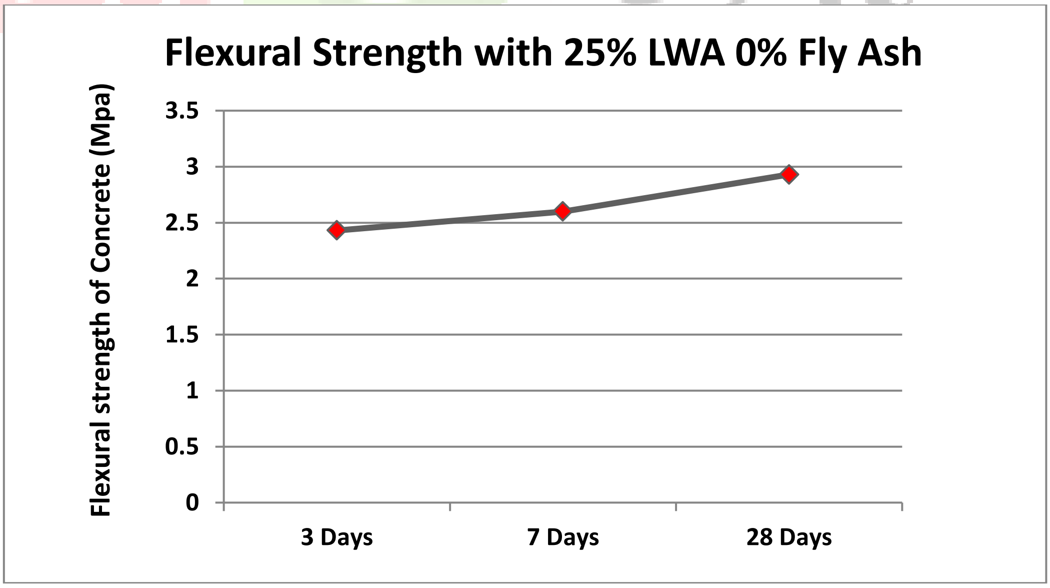

Figure 4.17modulus of elasticity with 25% fly ash and 0% LWA

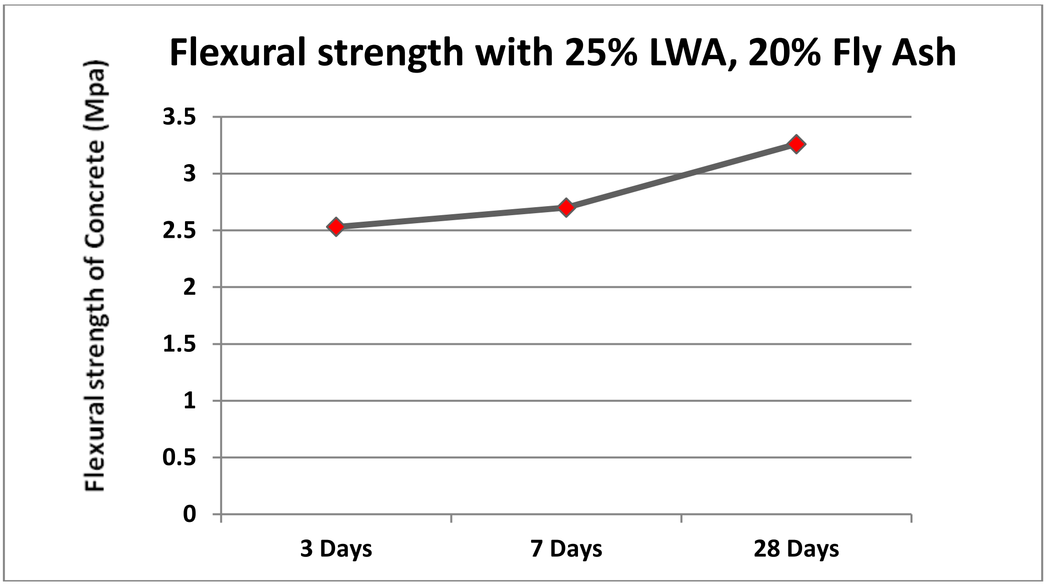

Figure 4.18modulus of elasticity with 25% fly ash and 20% LWA

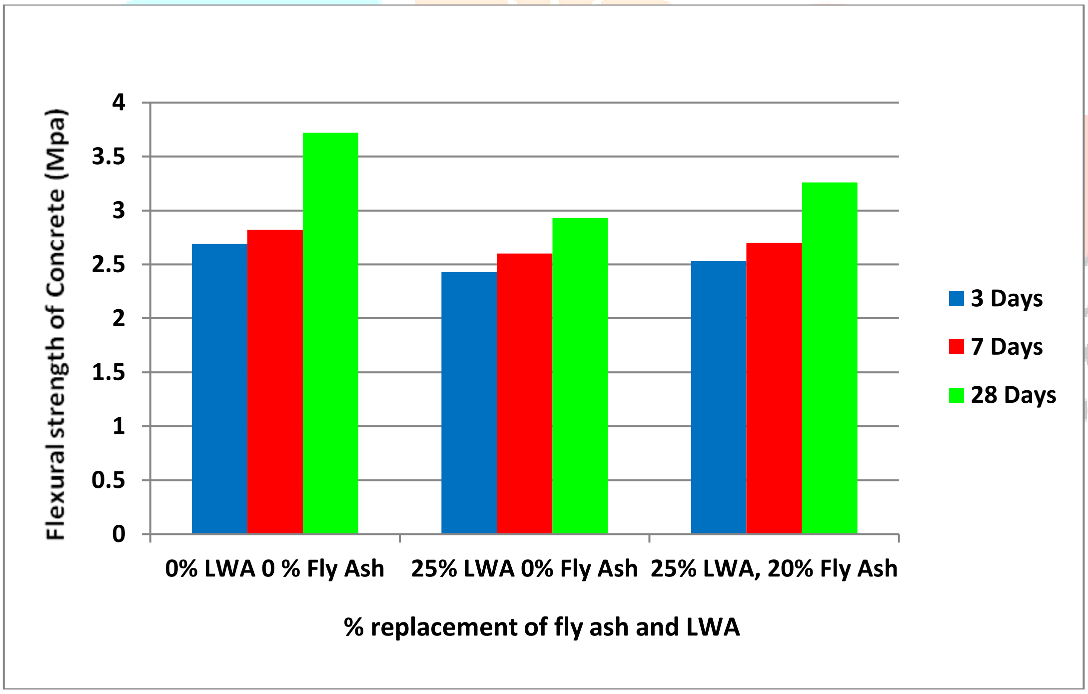

Figure 4.19 flexural strength of concrete

Figures 4.16 to figure 4.18 shows the graphs individually for different percentage replacements of fly ash and LWA and figure 4.19 shows the combined graph of replacement of fly ash and LWA.

CONCLUSIONS

The outcomes got with 25% light weight aggregate substitution in typical aggregate were examined with fly powder substitution in bond by 0%, 15% 20%, 25%, and 30%. At 20% substitution of concrete by fly fiery remains the most extreme compressive quality is watched for 25% LWA substitution in coarse aggregate.

1. Compressive quality tends to diminish with the utilization of LWA. At 28 days, typical cement achieved a compressive quality of 34 MPa, however with expanded LWA and Fly powder content compressive quality diminishes and at 20% Fly fiery debris and 25% LWA, compressive quality achieves its pinnacle estimation of 30.5 MPa.
2. The split rigidity at 28 days for 0% substitution of bond by fly fiery remains and 25% light weight aggregate substitution in typical coarse aggregate it is seen as 2.25 MPa
3. Further, split rigidity at 28 days for 20% substitution of concrete by fly fiery debris and 25% light weight aggregate substitution in ordinary aggregate it is seen as 2.7 MPa
4. The Flexural quality at 28 days for 0% substitution of the bond by fly fiery remains and 25% light weight aggregate substitution in ordinary coarse aggregate it is seen as 2.92 MPa.
5. Further the Flexural quality at 28 days for 20% substitution of bond by fly fiery remains and 25% light weight aggregate substitution in ordinary aggregate it is seen as 3.25MPa
6. The young's modules at 28 days for 0% substitution of bond by fly fiery debris and 25% light weight aggregate substitution in ordinary coarse aggregate it is seen as 2.58X104MPa
7. Further the young's modules at 28 days for 20% substitution of bond by fly fiery remains and 25% light weight aggregate substitution in typical aggregate it is seen as 3.663X104 MPaealand, ACI SP-171, pp. 651-670.[23] Bamforth, P.B. “The properties of high strength lightweight concrete,” Concrete 21(4), April 1987, pp 8-9

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