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Experimental Study of Concrete With Steel Mesh As Reinforcement And Value Added Materials

Naveen Kumar S.[1], T. M. Prakash[2], Lakshmi P.S.[3]

[1]Assistant Professor, Department of Civil Engineering, P.E.S College of Engineering, Mandya, India

[2] Professor, Department of Civil Engineering, P.E.S College of Engineering, Mandya, India

[3]Assistant Professor, Department of Civil Engineering, P.E.S College of Engineering, Mandya, India

Abstract

Concrete is a product obtained by mixing the ingredients in a planned definite proportion so that the resulting concrete is satisfactory in meeting the need for the job for which it is meant. Concrete is a widely used construction material due to many advantages relating to strength aspects. It is absolutely indispensable in modern society's fascination and infrastructure development. Innovations on this construction material are constantly being made to suit different conditions and applications. With the use of wire mesh in concrete, there could be increase in the strength of concrete viz compression, tension and flexure. This study relates the variation in the strength.

CHAPTER 2

MATERIALS

2.1 Cement

Cement is the vital constituent of concrete because it acts as an excellent binding property in concrete mix as well as offers good resistance to the moisture and possesses good plasticity. The two basic ingredients called as argillaceous materials containing clay and calcareous materials.

2.2 Aggregate

It is classified as,

(a) Fine Aggregate.

(b) Coarse Aggregate.

The fine and coarse aggregates are taken as per IS 383 (1970): Specification for Coarse and Fine Aggregates from Natural Sources for Concrete.

2.3. **Water**

The requirement of water is for proper hydration of cement, adequate workability in fresh concrete and for proper curing of hardened concrete. The water which is used for making concrete should be clean and free from harmful impurities such as oil, alkali, acid etc.

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2.4**. Square wire mesh**

Wire mesh with closely spaced wires is the most commonly used reinforcement in concrete .The mesh in either woven or welded construction uses include railing infill panels and many other applications. The gauge length of square wire mesh is 600×600 mm and having a diameter of 1.49mm and 600mm x600mm having diameter 1.65mm.

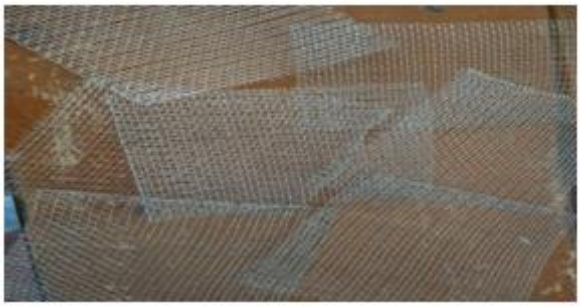

Fig 1. Wire mesh

CHAPTER 3

TESTS PERFORMED ON MATERIALS

3.1. Tests on Cement

Table 1.0 Results for tests of Materials.

Tests conducted	Test Results	References
Normal consistency (in %)	29	IS:12269-2008
Specific gravity	3.15	IS: 12269-2008
Setting time(minutes) a) Initial b) Final	 90 210	IS: 12269-2008 Should not be < 30 min Should not be < 600 min
Compressive strength of mortar cubes		
a. 3 days b. 7 days c. 28 days	32.3Mpa 43.5Mpa 58.2Mpa	Should not be <27Mpa Should not be < 37Mpa Should not be < 53Mpa

Table 1: Test results of Ordinary Portland Cement (OPC)

3.2. Tests on Fine Aggregate

Table 2.0 M-sand sieve analysis

Sieve No.	Weight retained (g)	Cumulative weight retained (g)	Cum. % of weight retained	% passing	% passing for grading zone-I as per IS-383-1970

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4.75	0	0	0.00	100.00	90-100
2.36	280	28	28	72	60-95
1.18	298	578	57.8	42.2	30-75
0.6	273	851	85.1	15	15-34
0.3	90	941	94.1	5.9	5-20
0.150	48	989	98.9	1.1	0-10
Pan	11	1000	100	0	

- G = 2.165
- Zone- I

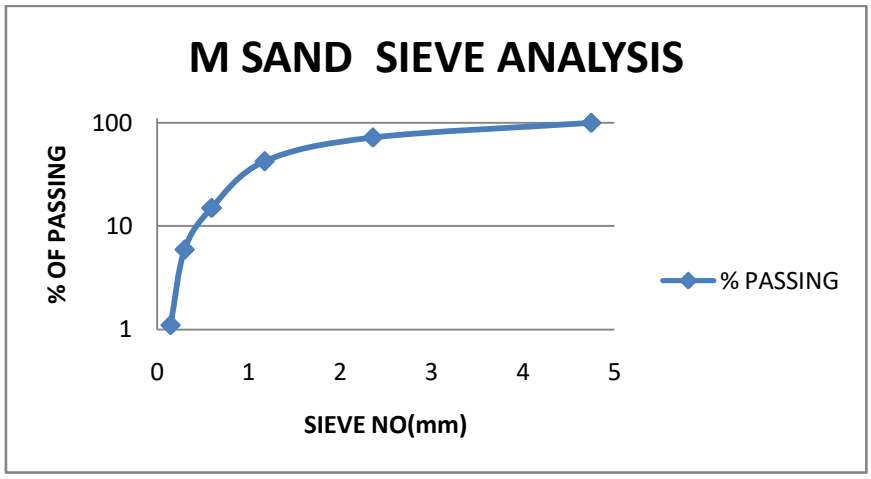

Fig. 2.0 Grain Size Distribution for Fine Aggregates

3.3. Tests on Coarse Aggregate

Table 3.0 Coarse aggregate sieve analysis (20mm Jelly)

Sl No.	I.S. Sieve designation in mm	Cumulative weight retained in Kg	% of weight retained	% passing	% passing for graded aggregate zone-I as per IS-383-1970
1	40	0.00	0.000	100.00	100
2	20	0.380	3.80	96.20	95-100
3	10	6.890	68.90	27.30	25-55
4	4.75	2.713	27.13	0.17	0-10

- G = 2.938
- Coarse aggregate used confirms to Table 2 of IS: 383-1970

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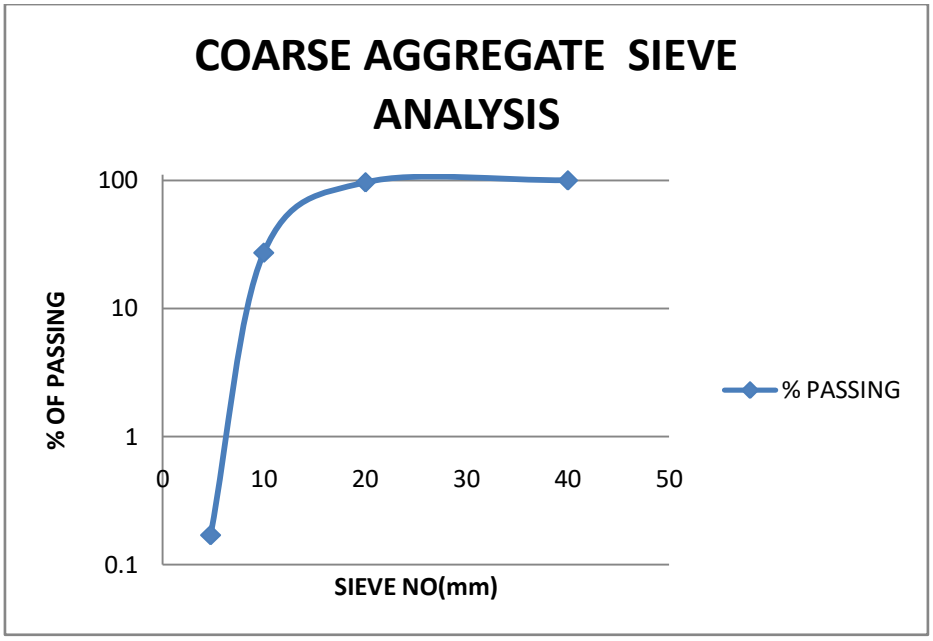

Fig. 3.0 Grain Size Distribution for Coarse aggregates.

3.4 Tests on hardened concrete

All the basic strength tests are being conducted, with Cubes (150mm), cylinder (150mm in dia and 300mm in length) and slabs (600mm X 600 mm x 1.49mm and 600mm X 600 mm x 1.65mm)

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 CUBES AND BEAMS

4.1.1COMPRESSIVE STRENGTH

Table 4. Compressive strength for 3 days

	compressive strength(N/mm^2)	**% variation in strength**
conventional concrete	22.08	-
1 layer mesh	23.08	4.52
2 layer mesh	27.55	24.77

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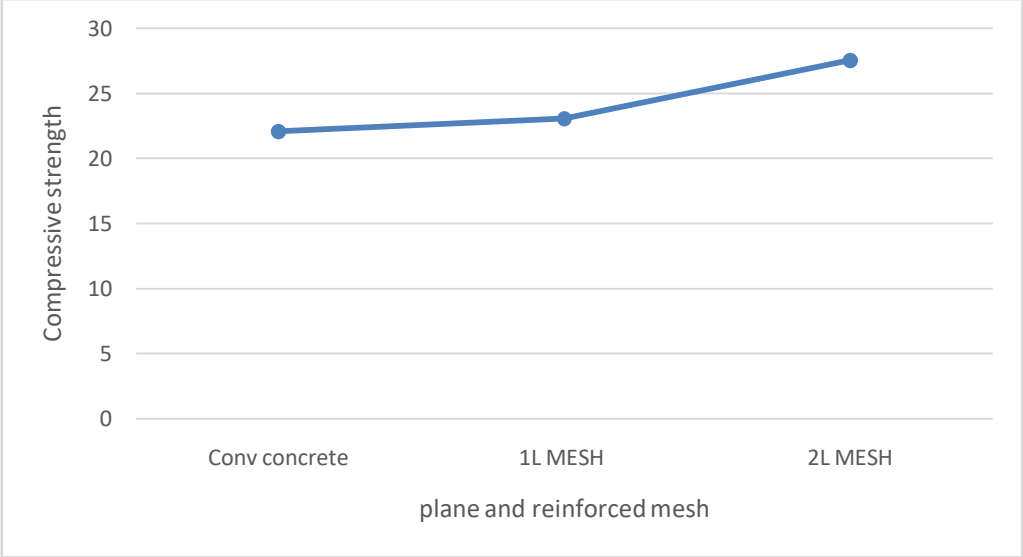

Fig. 4.0 Compressive strength for 3 days

Table 5. Compressive strength for 7 days

	compressive strength(N/mm^2)	**% variation in strength**
conventional concrete	25.24	-
1 layer mesh	27.89	10.499
2 layer mesh	30.75	21.83

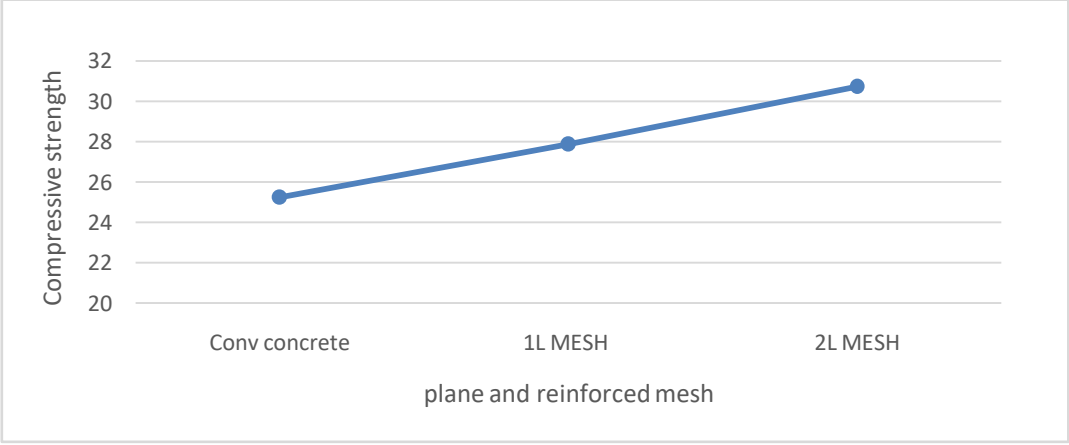

Fig. 5.0 Compressive strength for 7 days

Table 6. Compressive strength for 28 days

	compressive strength(N/mm^2)	**% variation in strength**
conventional concrete	34.4	-

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1 layer mesh	35.6	3.488
2 layer mesh	37	7.55

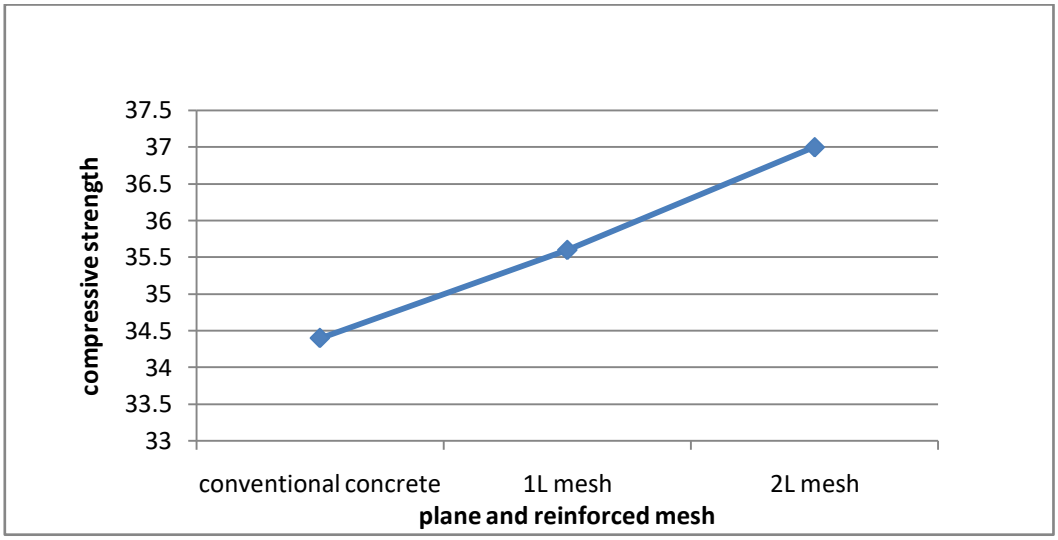

Fig 6: Compressive strength for 28 days

4.1.2. TENSILE STRENGTH

Table 7. Tensile strength for 3 days

	Tensile strength(N/mm^2)	**% variation in strength**
conventional concrete	0.862	-
1 layer mesh	1.711	49.56
2 layer mesh	1.84	113.45

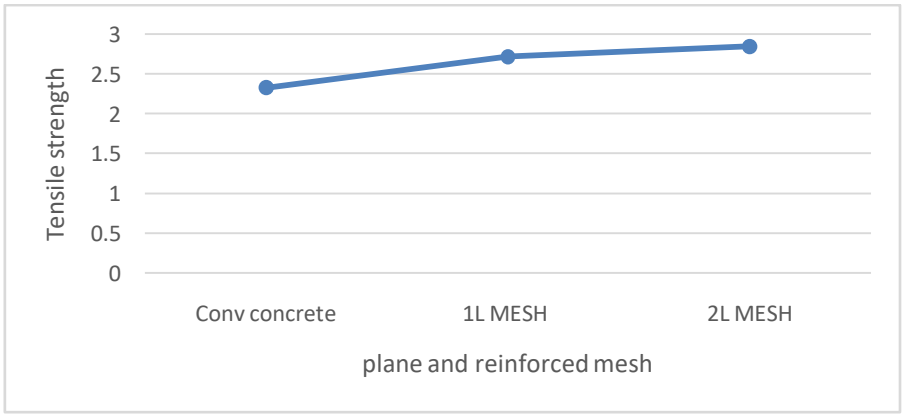

Fig 7: Tensile strength for 3 days

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Table 8. Tensile strength for 7 days

	Tensile strength(N/mm^2)	% variation in strength
conventional concrete	2.33	-
1 layer mesh	2.72	17.16
2 layer mesh	2.85	22.31

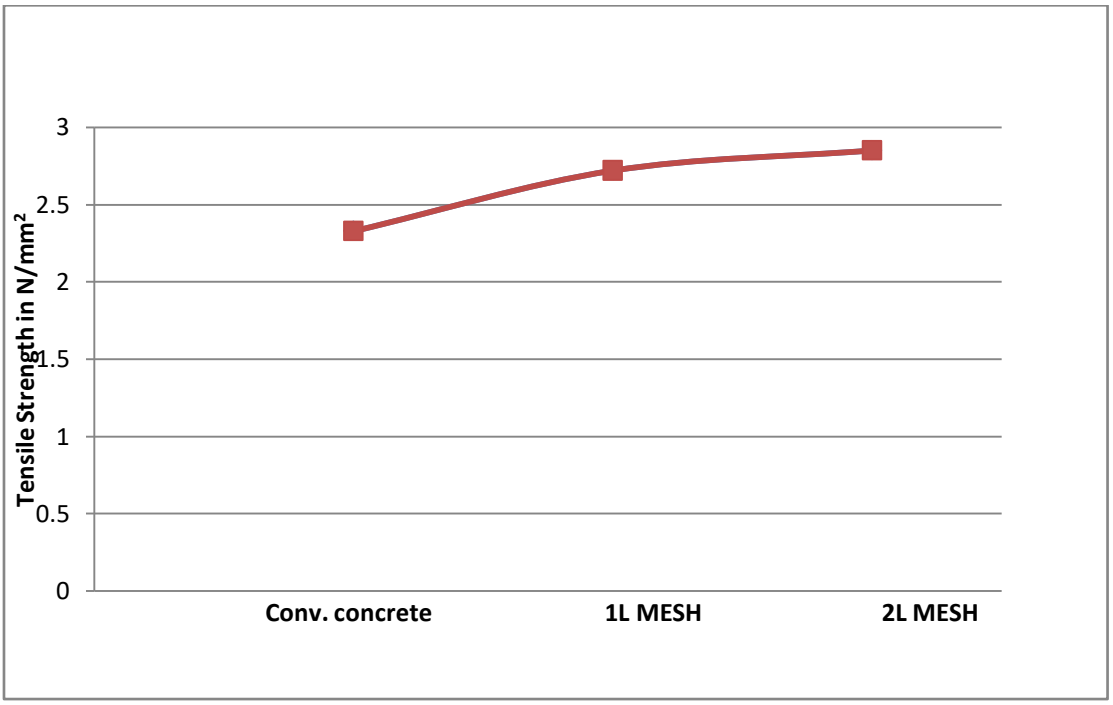

Fig 8: Tensile strength for 7 days

Table 9. Tensile strength for 28 days

	Tensile strength(N/mm^2)	% variation in strength
conventional concrete	2.67	-
1 layer mesh	2.97	11.23
2 layer mesh	3.25	21.722

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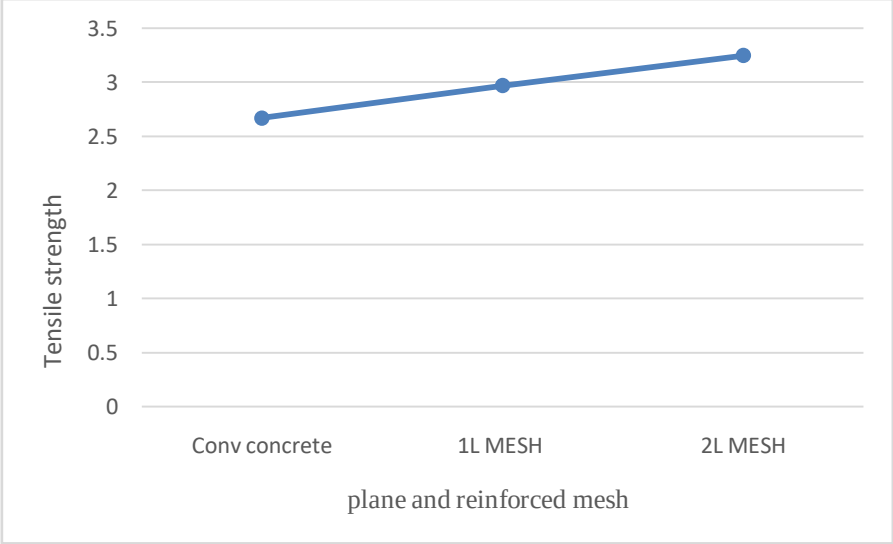

Fig 9:Tensile strength for 28 days

4.1.3. FLEXURAL STRENGTH

Table 10. Flexural strength for 3 days

	Flexural strength(N/mm^2)	**% variation in strength**
conventional concrete	1.8	-
1 layer mesh	3.1	72.2
2 layer mesh	3.2	77.77

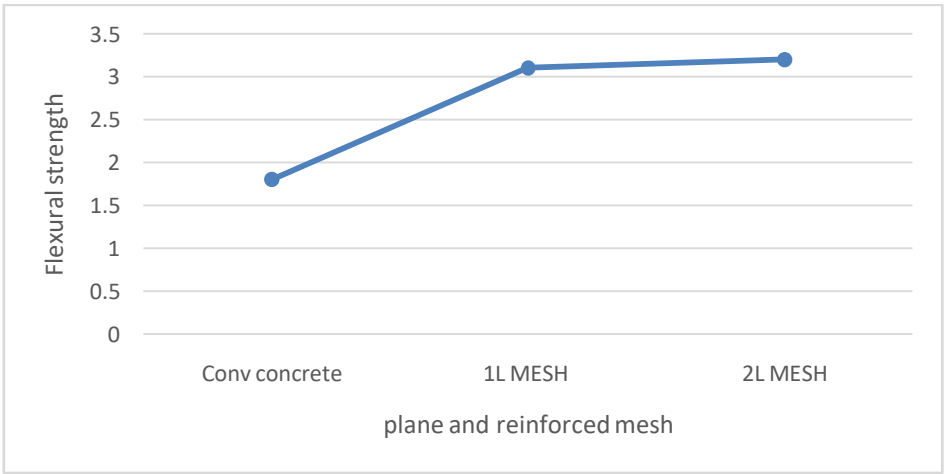

Fig 10: Flexural strength for 3 days

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Table 11. Flexural strength for 7 days

	Flexural strength(N/mm^2)	% variation in strength
conventional concrete	3.58	-
1 layer mesh	5.6	56.42
2 layer mesh	5.74	60.33

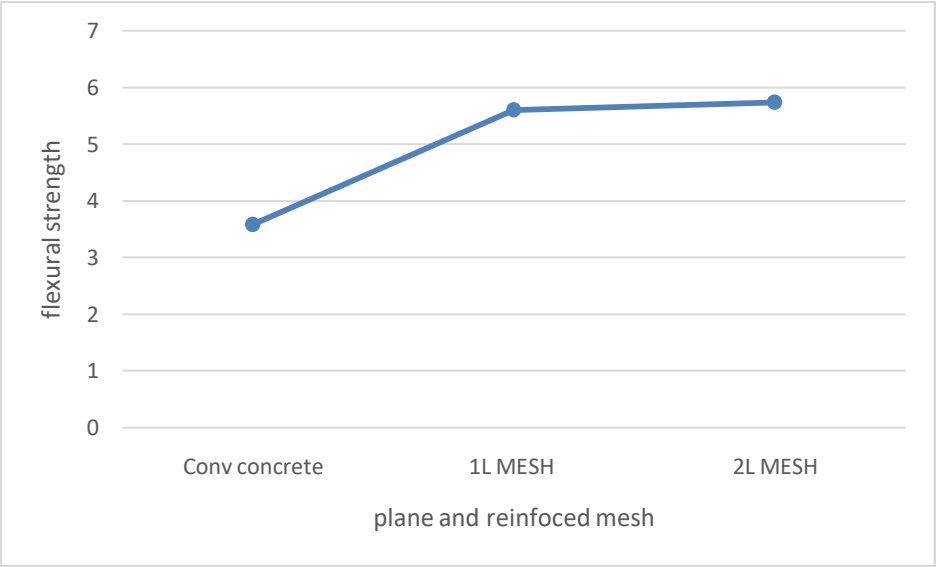

Fig 11: Flexural strength for 7 days

Table 12. Flexural strength for 28 days

	Flexural strength(N/mm^2)	% variation in strength
CONVENTIONAL CONCRETE	5.62	-
1 LAYER MESH	5.75	2.31
2 LAYER MESH	5.95	5.87

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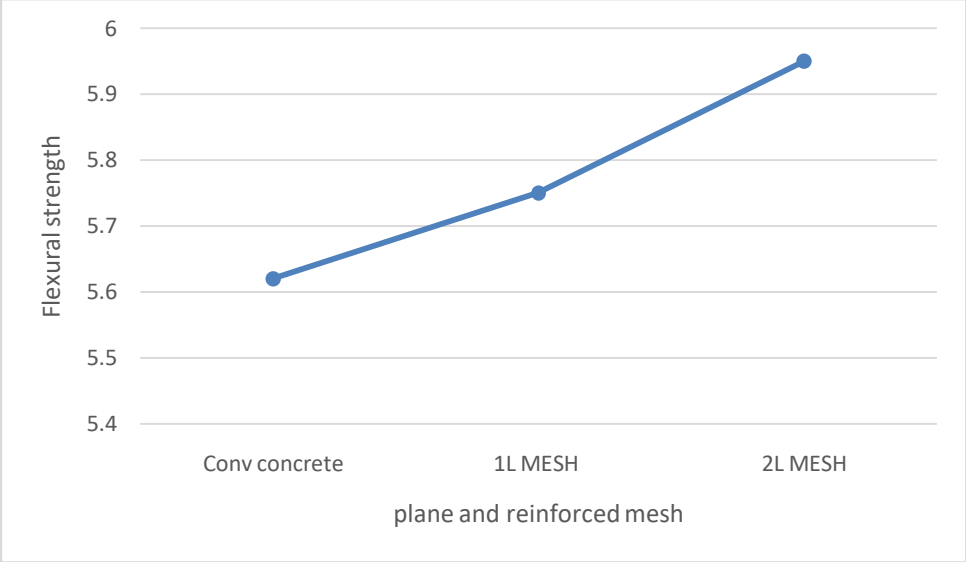

Fig 12: Flexural strength for 28 days

4.2 SLABS

PARTICULARS	ULTIMATE LOAD (kN)	15 DAYS (N/mm^2)
Plain slabs	19	0.2111

Table 13.0 Compressive strength for 7 days

PARTICULARS	ULTIMATE LOAD (kN)	7 DAYS (N/mm^2)
Plain slabs	13.27	0.1474
1 layer of small sized mesh (5mm dia, 1cm x 1cm Opening)	30.4	0.3378
2 layers of small sized mesh (5mm dia, 1cm x 1cm opening)	32.7	0.3633
1 layer of large sized mesh (8mm dia, 1cm x 1cm Opening)	22.75	0.2528
2 layers of large sized mesh (8mm dia, 1cm x 1cm Opening)	24.52	0.2724

Table 14.0 Compressive strength for 14 days

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Table 15.0 Compressive strength for 28 days

PARTICULARS	ULTIMATE LOAD (kN)	28 DAYS (N/mm^2)
Plain slabs	24.73	0.2748
1 layer of small sized mesh (1.49mm dia, 1cm x 1cm Opening)	35	0.3889
2 layers of small sized mesh (1.49mm dia, 1cm x 1cm opening)	42.5	0.4722
1 layer of large sized mesh (1.65mm dia, 1cm x 1cm Opening)	31.05	0.3450
2 layers of large sized mesh (1.65mm dia, 1cm x 1cm Opening)	57.62	0.6402

CHAPTER -5

CONCLUSION

5.1. CUBES AND BEAMS

The conclusions listed below are based on the strength obtained for 28 days.

1. The Compressive strength of concrete increased by 3.5% for one-layer mesh concrete.
2. The tensile strength of concrete is increased by 22% for placing 2-layer mesh concrete.
3. Flexural strength of concrete enhanced by 6% at for placing 2-layer mesh in concrete.
4. Placing mesh in concrete gives significant increase in tensile strength & flexural strength but does not have significant improvement in compressive strength.

5.2. SLABS

1. The rate increment in the load carrying capacity for a single layer small size mesh slab compared to plain slab for 28 days is 29%.
2. The rate increment in the load carrying capacity for a two layer small size mesh slab compared to plain slab for 28 days is 41.8%.
3. The rate increment in the load carrying capacity for a single layer large size mesh slab compared to plain slab for 28 days is 20.34%.

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4. The rate increment in the load carrying capacity for a two layer large size mesh slab compared to plain slab for 28 days is 57.7%.

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