LIGHT WEIGHT CONCRETE

CONTENTS

INTRODUCTION:

- Light weight concrete is a special concrete which weighs lighter than conventional concrete.

- Density of this concrete is considerably low (300 kg/m3 to 1850 kg/m3) when compared to normal concrete (2200kg/m3 to 2600kg/m3).

- Three types of LWC
  - Light weight aggregate concrete
  - Aerated concrete
  - No – fines concrete

PRINCIPLE BEHIND LWC:

The basic principle behind the making of light weight concrete is by inducing the air in concrete.

To achieve the above principle practically, there are 3 different ways.

- By replacing the conventional aggregates by cellular porous aggregates (Light weight agg. Concrete).
- By incorporating the air or gas bubbles in concrete (Aerated concrete).
- By omitting the sand from the concrete (No- fines concrete).

ADVANTAGES:

- Reduces the dead load of the building.
- Easy to handle and hence reduces the cost of transportation and handling.
- Improves the workability.
- Relatively low thermal conductivity
- Comparatively more durable
- Good resistance to freezing & thawing actio when compared to conventional concrete.

DISADVANTAGES

- Very Sensitive with water content in the mixture.
- Difficult to place and finish because of porosity and angularity of the aggregate .In some mixes the cement mortar may separate the aggregate and float towards the surface
- Mixing time is longer than conventional concrete to assure proper mixing .
- Lightweight Concrete are porous and shows poor resistance

APPLICATIONS

- Since the strength of L.W.C. is low, it is used in the construction of roof slabs, small houses with load bearing walls etc.
- It is also used in the construction of stairs, windows, garden walls, etc.
- In large buildings also, this is used in the construction of partition walls.
- These are moulded in the form of slabs and used as thermal insulators inside the building.

LIGHT WEIGHT AGGREGATE CONCRETE:

- Basically two types of light weight aggregates
  - Natural aggregates
  - Artificial aggregates
- Natural light weight aggregates are less preferred over artificial aggregates.
- Important natural aggregates – Pumice & Scoria
- Artificial aggregates are usually produced by expanding the rocks such as Shale, Slate, Perlite, Vermiculite, etc.,
- Type of aggregates decides the density of concrete.
- Density of concrete as low as 300 kg/m3 can be achieved.
- Compressive strength varies from 0.3Mpa to 40Mpa.

Natural light-weight aggregate	Artificial light-weight aggregate
(a) Pumice	(a) Artificial cinders
(b) Diatomite	(b) Coke breeze
(c) Scoria	(c) Foamed slag
(d) Volcanic cinders	(d) Bloated clay
(e) Sawdust	(e) Expanded shales and slate
(f) Rice husk	(f) Sintered fly ash
	(g) Exfoliated vermiculite
	(h) Expanded perlite
	(i) Thermocole beads.

PROPERTIES OF LIGHT WEIGHT AGGREGATES

- Pumice and Scoria are volcanic rocks having densities between 500kg/m3 to 900kg/m3.

- Natural aggregates have good insulating properties but subjected to high absorption and shrinkage.

PUMİCE

aggregate

blocks

METHODOLOGY

- BATCHING
- WEIGH BATCHING
- MEASUREMENT OF WATER
- PREPARATION OF CONCRETE CUBES
- COMPACTING
- CURING
- TESTING

MIX DESIGN OF LWC:

- Difficult to decide water – cement ratio, due to variable water absorption by aggregates.
- Generally done by trial mixing.
- Pre – saturation of aggregates is done to avoid excessive absorption of water by aggregates.
- Concrete with saturated aggregates will have higher density, which is bad in freezing & thawing action.
- In rare cases, aggregates are coated with bitumen to overcome the water absorption problem.

CASE STUDY

Experimental Study of Light Weight Concrete by Partial Replacement of Coarse Aggregate Using Pumice Aggregate

Cement

- ✓ Ordinary Portland Cement (53 Grade) with 29%.
- ✓ normal consistency conforming to IS: 8112-1989 was used.
- ✓ The specific gravity and fineness modulus of cement are 3.14 and 5%

Pumice Aggregate

- ✓ Pumice aggregate 20 mm sizes were used.
- ✓ Specific gravity of Pumice aggregate used is 0.82.

Coarse Aggregate

- ✓ Crushed stone coarse aggregate conforming to IS 383 – 1987.
- ✓ The values of loose and compacted, bulk density values of coarse aggregates 4.417 kg and 4.905kg,

Fine aggregate

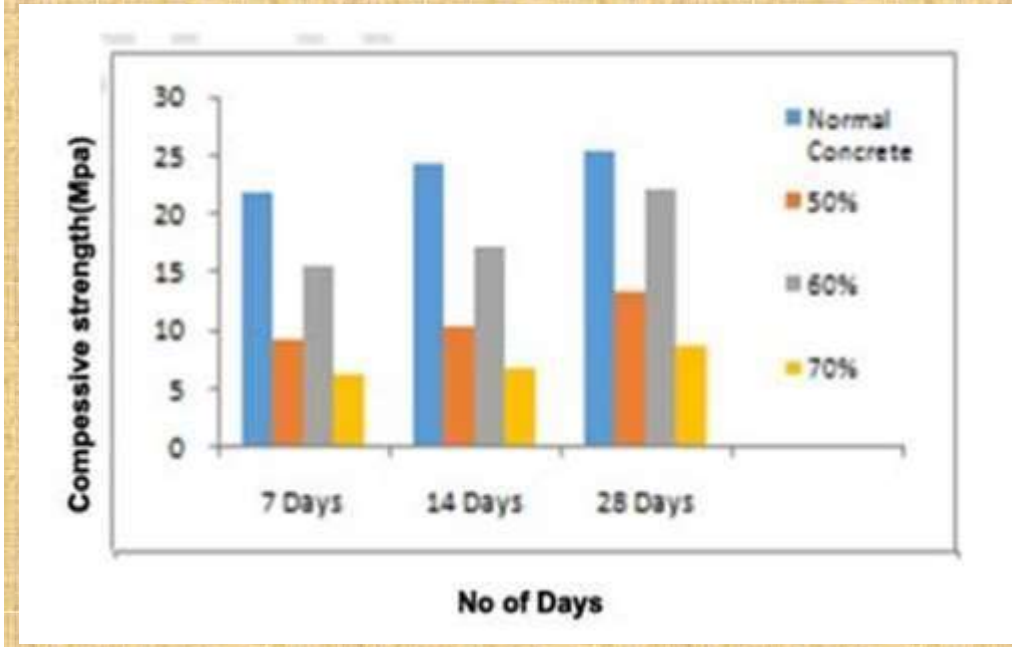
River sand was used throughout the investigation as the fine aggregate conforming to grading zone III.
The properties of sand by conducting tests according with IS 2386(part -1) -1963. The Specific gravity, fineness modulus, moisture content were determined

Water

- ✓ Water is an important ingredient of concrete as it actively participates in chemical reactions with cement.
- ✓ Clean potable water conforming to IS 456 – 2000 was used

CONCRETE MIX DESIGN

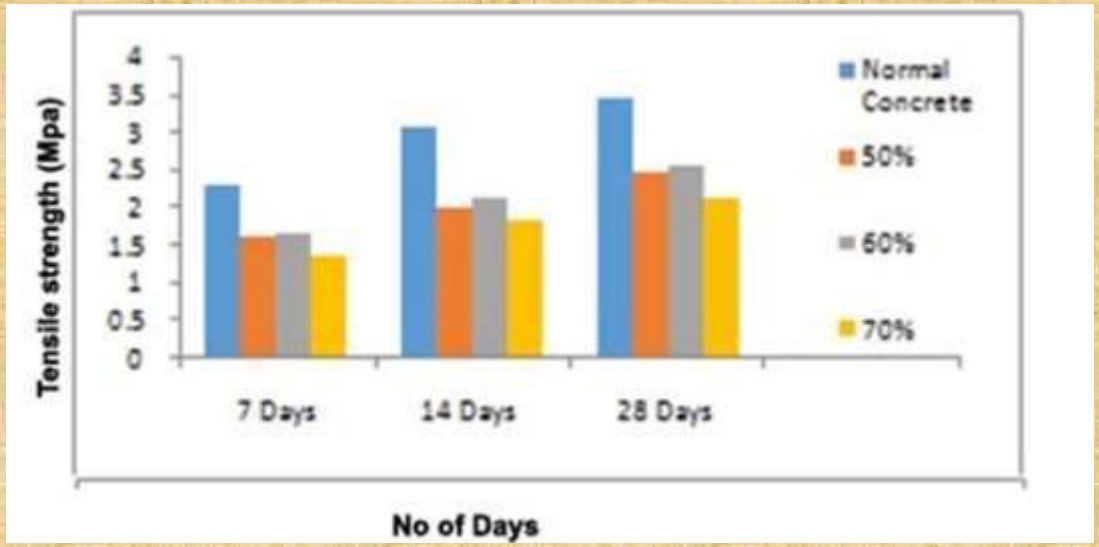
- ✓In the present study, M25 grade with nominal mix as per IS 456-2000 was used.
- ✓ Concrete mix proportion by weight for 1cubic meter and water cement ratio of 0.5.



Test results on compressive strength test

SI.NO	Percentagereplacement of Pumice	Average Compressiv N/mm^2 Strength		
		7 Days	14 Days	28 Days
1	0%	21.78	24.2	25.5
2	50%	9.33	10.36	13.32
3	60%	15.5	17.22	22.14
4	70%	6.2	6.89	8.85

Fig 3.5 Split tensile Test on cylinders



Percentage replacement of Pumice	Average Compressive Strength N/mm²		
	7 Days	14 Days	28 Days
0%	2.312	3.06	3.43
50%	1.62	1.98	2.48
60%	1.65	2.123	2.54
70%	1.38	1.84	2.123

CONCLUSION

- Compression strength value is compared to normal concrete and replacement of Coarse aggregate by Pumice from different percentages (50%, 60%, 70%).
- Maximum value of strength is obtained in 60%replacement by Pumice with coarse aggregate.
- Concrete with 60% replacement of pumice the compressive strength is comparable with normal concrete.
- This type of concrete can be utilized in wall panels of non load bearing type for use in precast buildings.

SUMMARY

- By using 60% of light weight aggregate as a partial replacement to NCA the compressive strength is promising.
- The density of concrete is found to decrease with the increase in percentage replacement of natural aggregate pumice aggregate.
- The compressive strength of concrete is found to increase with the decrease in pumice content.
- With the addition of mineral admixtures, the compressive, split-tensile and flexural strengths of concrete are increased. light weight aggregate is no way inferior to natural coarse aggregate and it can be used for construction purpose