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### RESEARCH ARTICLE

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#### A PARTIAL EXPERIMENTAL STUDY ON LIGHT WEIGHT CONCRETE USING WASTE IRON CHIPS AND INSULATION MATERIAL

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#### Manuscript Info

##### Key words:-

Lightweight Concrete, Waste Iron Chips,  
 Perlite, Insulation, Thermal Conductivity

#### Abstract

The lightweight concrete is advantage as compared to normal concrete. Lightweight concrete is defined as concrete is include an expanding agent to it increases the volume of mixture is giving additional qualities as mailability and les the dead weight. It lighter than the normal concrete. The main special tie of light weighted concrete is its low density and thermal conductivity. It is advantage to reduction dead load; it is faster building rates in construction, low transportation and handling costs. Waste iron chips are founded in industrial fabrication work such as drilling machine waste, lathe machine chopping waste and other iron small thin size chips in industry. In this Experimental Study we are use industrial fabrication waste. this material is waste so we use this material with replacement of Steel fiber as a reinforcement. A Structural lightweight aggregate concrete is design with natural Perlite aggregate it is providing an advantage to reducing the dead weight of a structure, also compare the strength of normal concrete with perlite concrete. partially replacing coarse aggregate to perlite by Cheng the water cement ratio in the perlite concrete.

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#### Introduction:-

In this project we studied related to light weight concrete including all their properties, this concrete has a low strength as compared to the ordinary concrete. We can experiment for achieving their strength and insulation properties. So, for that we added in concrete "waste iron chips" for improving their strength to some extent, along with insulating material is "Expanded Perlite" and admixture as a Foaming agent.

The specialty of light weighted concrete is low density and thermal conductivity.

The main advantages of lightweight concert are reduction of dead load, fast building work in construction and lower transportation and handling costs.

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## Literature Review:-

Study the literature Review for learning different things about the Lightweight Concrete Using Waste Iron Chips and Insulating Material.

### Effect of expanded perlite on the mechanical properties and thermal conductivity of lightweight concrete (2010)

In this paper provide more data in the effects of expanded perlite on the mechanical properties and thermal conductivity of lightweight concrete. In this paper mixture is prepare by partially replace natural aggregate to expanded perlite and the result, unit weights of light weight concretes are fresh state. W/C ratio is constant in all mixtures. water absorption, Compression strength is determined. Water absorption is increase with the high perlite content. In this paper test result indicated that the thermal conductivity is substantially improved is use of perlite. A strong relationship between the thermal conductivity and unit weight is obtained.

### The effects of aggregate properties on lightweight concrete (2006)

In this paper study of the effects of several factors on the strength of lightweight aggregate concrete is aggregate strength, w/c ratio and the porosity of the interfacial zone and cement paste is hard. Concrete sample is three different water cement ratios is compar. The crushing strength of three grade of expanded clay, lightweight aggregate and in the pore distribution of the hard cement paste is measure. Increase the W/C ratio is found to decrease the strength of light weight aggregate concrete. The number of pores in cement paste and aggregate/cement paste found to increase.

### Lightweight aggregate concrete fibre reinforcement (2012)

In this paper higher brittleness and lower mechanical properties of lightweight aggregate concrete compared to normal weight concrete at the same compressive strength is prevented. Studied is show that the use of fibre in lightweight aggregate concrete is appropriate solution of problems. In general, as single or hybrid form, improve it mechanical property, and increase its toughness, energy absorption and ductility performance, is decrease its workability, when steel fibre is use in the concrete mixture. Case of split tensile and flexural strengths.

### Mechanical Properties of the Light Weight Foamed Concrete with Steel Fibber of Different Aspect Ratio (2018)

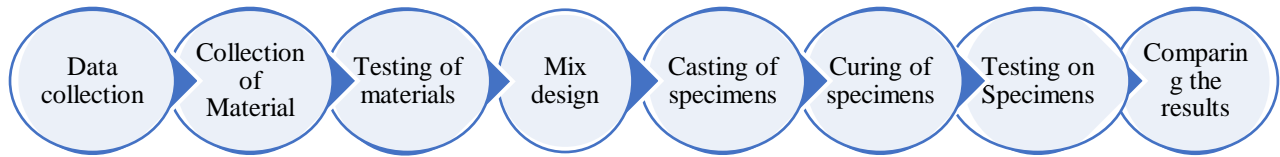
In this paper Despite the feature of the light-weight foam concrete many of the building due to the advantage of thermal and sound insulation is lightweight. But it is brittle and weak compare with the normal concrete. So that the use of the steel fibre will improve to the physical properties of foamed concrete. This paper study focused on the effect of different aspect ratio to the different lengths of steel fibres with same volume of friction volume of the mix for foamed concrete. The mechanical property included fresh and hard concrete property as flow, fresh density, hard density dry density strengths in term of flexural, compressive, splitting tensile modules of elasticity.

### Durability of Structural Lightweight Concrete Containing Expanded Perlite Aggregate (2020)

In this paper focused on the development of durable structural lightweight concrete by expanded perlite aggregate (EPA). In this paper to ensure its durability when the expos to chloride environment, concrete is produced with low W/C ratio and ordinary Portland cement (OPC) is replace silica fume (SF), ground granular blast furnace slag (GGBFS) etc. The durability of concrete and compressive strength, determining the unit weight, flexural strength, to the resistance of concretes to corrosion on reinforced steel. Thermal insulation property is determine using a hot guard plate. The results show to the unit weight of concrete is reduced compare with the normal weight concrete (NWC). In the compressive strength of the develop LWC is sufficient to be used as structural concrete.

### Gap finding

1. Not used waste iron chips in Light weight Concrete
2. Low Strength of light weight concrete
3. Workability of Light weight Concrete
4. Cost Analysis

**Methodology:-****Expanded Perlite**

1. Perlite is a mined mineral that undergoes some physical processing. The actually allow by the National Organic Standards Board for use in certified organic agriculture.
2. This is the highest porosity and drain capability.

Properties	Result
Size	1mm to 5mm
Color	White
Bulk Density	100 to 120 kg/m <sup>3</sup>

**Expanded Perlite****Waste iron chips**

Waste iron chips are founded in industrial fabrication work such as drilling machine waste, lathe machine chopping waste and other iron small thin size chips in industry.

Properties	Result
Shape	Spiral
Diameter	2mm to 10mm
Length	10mm to 70mm



#### Waste iron chips

#### Foaming agent.

1. Aquatek – FOAM CON is a unique foam agent to produce lightweight concrete which is use as a roof insulation material and for product of light weight precast block, the density varying between 320 – 2080 kg/m<sup>3</sup> Aquatek–FOAM CON it is specially developed to provide the maximum thermal insulating effect in concrete.
2. Foamed concrete is made from Aquatek–FOAM CON is light in weight does not increase the significantly the dead load on the Structure.
3. It has good, mechanical stability and is excellent shock absorber.

#### Foaming agent

#### Casting of concrete Block



Casting of normal concrete Block



Casting of Light weight concrete Block



**Curing of concrete Block**

**Compressive strength of concrete Block**



**Crack Pattern of Concrete Block**



**Normal concrete Block**

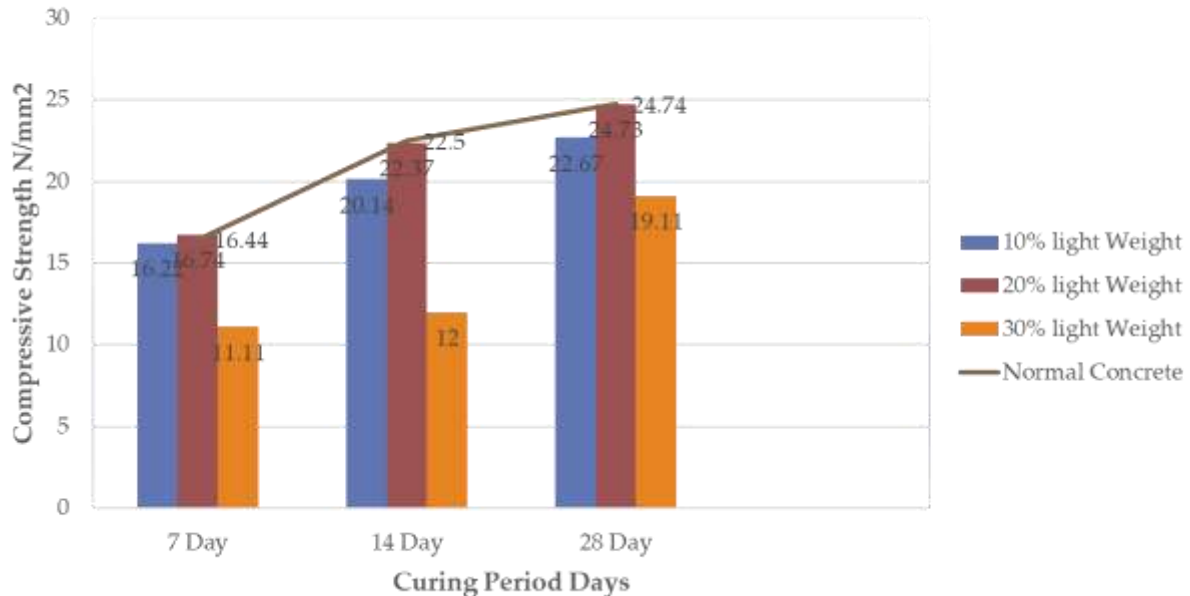
**Light weight concrete Block**



Compressive Strength of Normal Concrete And Light Weight Concrete, M 25 Grade.

Sr. no.	Days	Normal Concrete Strength (N/mm <sup>2</sup> )	light Weight concrete Strength (N/mm <sup>2</sup> )	light Weight concrete Strength (N/mm <sup>2</sup> )	light Weight concrete Strength (N/mm <sup>2</sup> )	Strength % As per IS 456 : 2000	
			10%	20%	30%		
1	7 Days	16.67	16.22	16.74	11.11	16.25	65 %
2	14 Days	21.78	20.14	22.37	12	22.50	90%
3	28 Days	24.89	22.67	24.73	19.11	24.50	99%

Compression Test on Concrete Cube

**Conclusion:-**

The Lower amount of lightweight aggregate and air-entraining provides higher strength in concert. Increasing porosity decreased the density but also thermal conductivity of concert. Applying porous mortar is effective in increasing insulation property of concrete. Strength of lightweight concrete depend on the strength of lightweight aggregate used to harden cement paste, The bond to the aggregate/cement paste.

**Reference:-**

1. Ozkan Sengul, Effect of expanded perlite on the mechanical properties and thermal conductivity of lightweight concrete, ScienceDirect 43 (2011) 671–676
2. Tommy Y. Lo, The effects of aggregate properties on lightweight concrete, ScienceDirect (2007) 3025–3029
3. Mahmoud Hassanpour , Lightweight aggregate concrete fiber reinforcement – A review, ScienceDirect 37 (2012) 452–461
4. M.J. Shannag , Characteristics of lightweight concrete containing mineral admixtures, ScienceDirect 25 (2011) 658–662
5. Annie Sweetlin.J.P , Experimental Study of Light Weight Concrete using Perlite, (IRJET) Volume: 07 Issue: 05 | May 2020
6. Er. Nalin Verma, Effect of Partial Replacement of Cement with Blast Furnace Slag and Sand with Cast Iron Chips on the Strength of Concrete, (IJERT) ISSN: 2278-0181 Vol. 5 Issue 10, October-2016
7. Suhad M.Abd, Mechanical Properties of the Light Weight Foamed Concrete with Steel Fiber of Different Aspect Ratio, (ISCES) 2018
8. Mohammed Ibrahim, Durability of Structural Lightweight Concrete Containing Expanded Perlite Aggregate, ScienceDirect 2020

9. Sandesh Dhavale , Cellular Light Weight Concrete using Glass Fiber, (IJERT) ISSN: 2278-0181 Vol. 9 Issue 09, September-2020
10. Muhammad Asim, Comparative experimental investigation of natural fibers reinforced light weight concrete as thermally efficient building materials, Science Direct 31 (2020) 101411
11. Hjh Kamsiah Mohd.Ismail, Study of lightweight concrete behaviour, Science Direct Vol No : 71908 (2015)
12. Kamarul Aini Mohd Sari, Applications of Foamed Lightweight Concrete, DOI:10.1051/mateconf/20179701097 ETIC 20 16
13. Suhad M.Abd, Mechanical Properties of the Light Weight Foamed Concrete with Steel Fiber of Different Aspect Ratio, 2018 1st International Scientific Conference of Engineering Sciences - 3rd Scientific Conference of Engineering Science (ISCES)
14. Vishakh T M, Lightweight Aggregate Concrete Using Expanded Polystyrene Beads-A Review, (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 11 | Nov 2018 www.irjet.net p-ISSN: 2395-0072
15. Venkatesh, A Study on the Mechanical Properties of Light Weight Concrete by Replacing Course Aggregate with (Pumice) and Cement with (Fly Ash), (IJERT) ISSN: 2278-0181 Vol. 4 Issue 08, August-2015
16. G.M. Tsaousi, Development of lightweight insulating building materials from perlite wastes, Vol. 69, Issue 333, January March 2019, e175 ISSN-L: 0465-2746
17. Sukmin KWON, Development And Application Of Lightweight Cement-Based Composites, <https://www.researchgate.net/publication/268152619> May 2013
18. K. Naveen Kumar, An experimental investigation on light-weight concrete blocks using vermiculite, Science Direct (2019)
19. Jihad Hamad Mohammed, Materials, properties and application review of Lightweight concrete, Rev. Téc. Ing. Univ. Zulia. Vol. 37, N° 2, 10 - 15, 2014
20. Adilson Schackow, Mechanical and thermal properties of lightweight concretes with vermiculite and EPS using air-entraining agent, Science Direct (2014)
21. Fan Wu, Durability of thermal insulating bio-based lightweight concrete: Understanding of heat treatment on bio-aggregates, Science Direct (2021)
22. Marta Kadela, Characteristics of Lightweight Concrete Based on a Synthetic Polymer Foaming Agent, Science Direct Published: 5 November 2020
23. Pragati J. Jagtap, A Review Paper on Comparative Study of Lightweight Concrete and Reinforced Concrete, (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072
24. Sang-Yeop Chung, The Effect of Lightweight Concrete Cores on the Thermal Performance of Vacuum Insulation Panels, Science Direct Published: 9 June 2020
25. Ali J. Hamad, Materials, Production, Properties and Application of Aerated Lightweight Concrete: Review, International Journal of Materials Science and Engineering Vol. 2, No. 2 December 2014
26. Concrete Technology Book (Theory and Practice) M. S. SHETTY
27. IS Code
  - IS : 2386 (Part I) – 1963 Particle Size and Shape – Sieve Analysis
  - IS : 2386 (Part III) – 1963 Bulk Density, Specific Gravity, water Absorption
  - IS : 2386 (Part IV) – 1963 Impact Value
  - IS : 12269 – 2013 Soundness by Le' chatelier method, Initial Setting time, Final Setting time , Standard Consistency test
  - IS : 456 : 2000
  - Water cement ratio Table no. 5 ( Clause 6.1.2 )
  - Minimum cement content ( Clause 6.1.2 )
  - Standard Deviation Table no. 8 (Clause 9.2.4. 2)