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# EXPERIMENTAL INVESTIGATION OF PROPERTIES OF LIGHT WEIGHT CONCRETE USING PLASTIC FIBRES

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## ABSTRACT

Lightweight concrete is much lighter than standard concrete. The use of lightweight coarse materials such as shale, clay, or slate in its construction gives it its low density. More and more contemporary foundations are using it as an alternative to conventional concrete. One defining feature of lightweight concrete is its low density. In general, the density of concrete falls somewhere between 300 and 2200 kg/m³, however it may vary anywhere from 2200 to 2600 kg/m³. In cases where structures resist load by self-weight, this material becomes ineffective because to the reduction of its self-weight caused by employing lightweight concrete. But if you add certain fibers and mineral admixtures, it may be stronger and last longer. We tested its strength and durability after7,14, and 28 days after adding the fibers and admixture, to finish the work. The incorrect disposal of waste plastic is causing environmental pollution. Plastic is not biodegradable, thus it will not dissolve in soil or water. However, it has the negative side effect of polluting both surface and groundwater. Plastic, when burnt, releases a myriad of toxic gases. It includes processes for reuse or recycling. There is, therefore, the possibility of using fibers produced from recycled plastic.
The fibers that make up a crack arrester in a matrix made of cement prevent flaws from spreading through the matrix and eventually breaking when subjected to stress. As a foundational material, this project makes use of M20 Grade concrete, to which waste plastic fibers are volumetrically incorporated. In this experiment, we used an aspect ratio of 50 and tested with various percentages of waste plastic fibers:0%,0.5%,1%,1.5%,2%,2.5%, and 3%.

So, we're trying to find out what happens when we add polythene fibers in this experiment. After testing plastic fiber concrete cubes, the results are compared to those of regular cement concrete. Plastic fibers may improve several concrete properties, such as its compressive strength, impact resistance, cracking resistance, and split tensile strength.

## INTRODUCTION

Lightweight concrete may be described as a kind of concrete that is enhanced with an expanding agent. This compound not only increases the volume of the mixture but also imparts other desirable features, such as nailbility and a reduction in dead weight. The weight is lower than that of conventional concrete. Lightweight concrete has been used by several countries, including the United States, the United Kingdom, and Sweden. Lightweight concrete is characterized by its low density and excellent heat conductivity.

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There are many advantages, such as a decrease in dead load, faster building rates, and lower shipping and handling costs. If you want to keep the wall's open areas without worrying about laitance layers or cement films, try placing lightweight concrete on top of it. The performance of aerated lightweight concrete was the basis of this investigation. But there's a certain ratio of water to cement that has to be met to make sure the mixture is cohesive enough. When there isn't enough water to bind the particles together in concrete, it loses some of its strength. Similarly, if there is an overabundance of water, cement may not be as strong because it will run off and aggregate to form laitance layers.

One variant of normal concrete, lightweight concrete is much less heavy. Because it is made out of small, light stones like slate, shale, or clay, it has a very low density. It is becoming more popular in the building of contemporary foundations as a viable alternative to conventional concrete. A low density is characteristic of lightweight concrete. Normal concrete has a density somewhere in the center of the 300–2200 kg/m$^3$ range. The main features of lightweight concrete are its low density and its thermal conductivity. Some of its advantages are less dead load, faster construction rates, and lower shipping and handling expenses. The slender concrete edifice referred to as "The Pantheon" still stands tall in Rome, over eighteen centuries after it was built. It proves that lighter, less expensive materials may be used in concrete construction.
Even while plastic is generally well-received and has no negative effects on human health, it does become an environmental problem after it has served its purpose. India plans to increase its plastic use from its current 4 million metric tons to 20 million metric tons by 2014. Since plastics are often believed to be a big problem, they have taken center stage in discussions about solid waste management. Unfortunately, plastics cannot be degraded. They endure for a long time and, when burned unchecked, may release a broad range of toxic air pollutants (HAPs) due to the many polymers and additives used. Plastics do degrade a little bit after each heat treatment, even though they may be recycled and given new life.

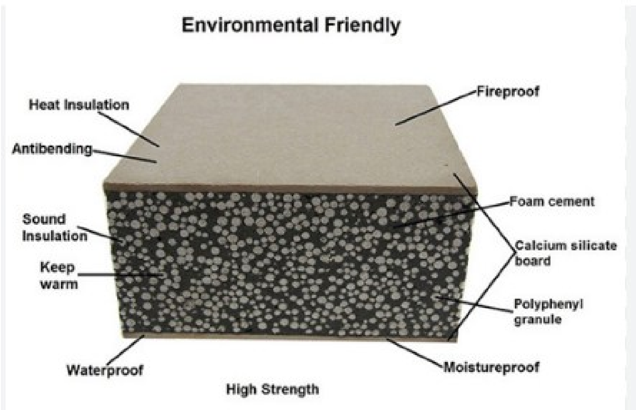


**Fig: Light weight concrete as Environmental friendly**

The addition of fibers to concrete increases the mixture's early resistance to plastic shrinkage cracking, further protecting the concrete from drying shrinkage cracks. It reduces the surface water permeability of the concrete and increases its durability. By placing it above rebar, the plastic is less likely to settle and shatter. Finishing becomes easier and smoother as a result. Along with the previously stated benefits of a harder, longer-lasting surface with increased abrasion resistance, it also helps to achieve less water bleeding to the surface during concrete laying, which reduces the migration of cement and sand to the surface.

### 1.2. TYPESOFLIGHTWEIGHTCONCRETE

Lightweight concrete may be made in a few different ways: by adding air to the mixture, by removing the smaller aggregate particles, or by substituting them with a porous, cellular, or hollow aggregate. Lightweight concrete specifically belongs to three categories: it. Cement that does not include any particles ii. Lightweight aggregate concrete

IIii. Aerated or foamed concrete

i. Fines-free asphalt

Avoid fines One definition of concrete is "lightweight concrete," which consists of cement and little particles. Vapors are generated evenly over its whole volume. The main characteristics of this form of lightweight concrete are that it retains its large voids and does not need laitance layers or cement film when applied to walls. As seen in Figure 1, the concrete is free of particles.

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**Fig 2 : No FineConcrete**

Steer clear of penalties Both load-bearing and non-load-bearing applications of concrete exterior walls and partitions are common. To make no-fines concrete stronger, more cement is needed. However, this is affected by the chemical makeup of the water. Inadequate water content in concrete causes particles to not bind as effectively, ultimately leading to the material's weakening. In a similar vein, laitance layers weaken concrete as a whole when there is an excess of water in the mix. This happens when the cement film drains off the aggregate.

i. THE CHARACTERISTIC MIX

This lightweight variation uses flow-specific porous lightweight aggregate in place of conventional concrete. Pumice and scoria are examples of natural stones, whereas vermiculite, expanded blast-furnace slag, and clinker aggregate are examples of synthetic materials that may be used to make lightweight aggregates. This lightweight aggregate's low specific gravity is primarily caused by its high porosity. Lightweight aggregate concrete may be classified into two categories based on the uses it is put to. The two most common types of lightweight aggregate concrete are structured and partly compacted. Precasting and allied industries make extensive use of partly compressed lightweight aggregate concrete.

Roof and wall panels made of concrete. This kind of concrete is less likely to break due to its low density and strength; it also offers excellent thermal insulation and less drying shrinkage. Conventional reinforced concrete with dense aggregate is compressed to the same degree as structurally lightweight aggregate concrete. When combined with steel reinforcement, it creates a solid connection. For steel to remain uncorroded, the concrete must be thick enough. Concrete is infamously difficult to work with because it contains coarse fine aggregate in addition to material that is both textured and oddly formed. It is not advisable to use lightweight particles with a greater specific gravity for instructional concrete.

Light Weight Aggregate 3W,Concrete

## i. AERATEDCONCRETE

The absence of coarse particles in aerated concrete is similar to that in aerated mortar. In order to make aerated concrete, a cement slurry is combined with fine sand and then gas is added. Lime, instead of cement, and powdered fuel ash, another siliceous substance, are common alternatives to sand in industrial applications. There are two methods to get the aerated concrete ready. The first stage involves injecting the gas via a chemical reaction while the mixture is in its plastic form. Combining stable flora or whirling it through the air with an agent that entrains the air is the second way to introduce an iris. The first method is often used in precast concrete factories for producing concrete with areaonable high strength and little drying shrinkage. Afterwards, the precast units undergo autoclaving. The second method is more appropriate for in-situ concrete applications including insulating roof screeds and pipe lagging. Figure 2 depicts the aerated concrete.

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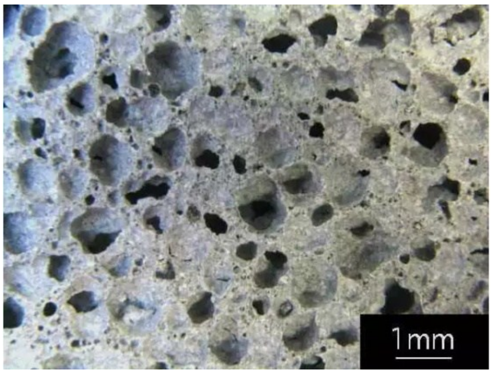
Vol 19, Issue 3, 2025

**Aerated Concrete**

A key component that determines the variances among the several types of lightweight concrete is the aggregate grade used in the mixtures. The suitable aggregate kinds and grades for the different types of lightweight concrete are shown in Table 1.




**Typesand Grading of Light weight Concrete**

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Vol 19, Issue 3, 2025

# LITERATURE REVIEW

**Divya Bhavana and Ropula Kishore Kumar, S. Nikhil, P. Sairamchander**

Lightweight concrete has a lower compressive strength than typical, conventional concrete, according to their research. In addition, they found that the compressive and flexural strengths diminish with increasing ECA percentages. This is because ECA decreases concrete density. Compared to conventional, traditional concrete, lightweight concrete offers higher workability, is easier to work with, and has a low heat conductivity. With the assistance of Akshata A. Mulgund and Dilip Kulkarni, MD They tested the densities of lightweight and standard concrete as part of their lightweight concrete experiment. Lightweight concrete, which has a much lower density than conventional concrete, helps to decrease dead load, expedites building, and maintains structural economy.

Yasar et.al. looked at using basaltic pumice (scoria) as aggregate and fly ash as a mineral additive to create structural lightweight concrete that might decrease dead weight. The compressive and flexural tensile strengths of the hardened concrete were measured, in addition to the fresh concrete's properties such slump workability and density. The use of scoria in the production of SLWC was confirmed by the results of controlled-environment compressive and tensile strength tests. With SLWC, the dead weight of the structure may be reduced by an average of 20% due to the fact that NWC has a dry weight unit of around 2300 kg/m3.
Parhizkar et al., researcher T.
The experimental substances included lightweight pebbles, volcanic pumice, and cretons. This is why two sets of compact The physical/mechanical and durability properties of two varieties of concrete are built and studied by researchers: lightweight coarse aggregates concrete with natural fine particles and lightweight coarse aggregates concrete with fine aggregates. Based on the results of compressive strength, tensile strength, and drying shrinkage, these lightweight concretes meet the structural lightweight concrete standards.

Bangalore process
The study on plastic roads developed by the Bangalore Process in 2002 is shown here. A plastic road of 25 kilometers was built in Bangalore. In comparison to the non-plastic road that had been laid simultaneously but began to crack soon after, the plastic road was more uniform, smooth, and rutted less. The method was also greenlit in 2003 by the Central Road Research Institute Delhi (CRRI). Increasing the stickiness of the concrete mixture increases the road's endurance by, among other things, helping the stones cling together more securely and making the mix more resistant to water.
Adnan t. Mustafa
One kind of polymer was investigated by Mohammad T. Awwad et al. (2007) as a potential means of enhancing the properties of concrete mixes. One of the aims is to determine the best sort and quantity of polyethylene to use. Low density polyethylene (LDPE) and high density polyethylene (HDPE) were used to cover the aggregate. The results show that the engineered properties of ground HDPE polyethylene modifier are better. It is recommended to use 12% modifier by weight of concrete. It improves the material's stability, makes it lighter, and adds some air and mineral aggregate gaps,

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Vol 19, Issue 3, 2025

# METHODOLOGY

## OBJECTIVES OF THE PROJECT

In order to create aggregate concrete that is both lightweight and durable, we will be adding polymer fibers in various quantities and then testing the results. In order to determine the characteristics of both coarse and fine aggregate. When fatigue stress is applied, both plain and fiber concrete molds are cast.

In order to find out what proportion of plastic trash is contributing to the increased strength of concrete molds,
In order to find out how LWC absorbs water and compare it with control concrete.
in order to compare the resulting concrete with control concrete and see out how much mass and strength LWCaga incid attacks.
- To build a lightweight concrete mix utilizing lightweight aggregate and compare it to the control mix. - To find out how well LWC absorbs water and compare it to the control mix.
A comparison between the strength and density of LWC and regular concrete
3. 2. Density and strength-based lightweight concrete types
LWC falls into many categories:-
Firstly, low-density concrete
2. Concrete with a moderate strength
3. Concrete used for building
1. Concrete with a Low Density
Insulation is the primary use for them. High thermal insulation value and low unit weight (rarely more than 800 kg/m³). From around 0.69 to 6.89 N/mm2 is the low range for compressive strength.
Concrete of Moderate Density Second
These concretes are a hybrid of structural and low density varieties; their usage necessitates a reasonable amount of compressive strength. 'Fill' concrete is another name for them. There is an intermediate range for compressive strength (around 6.89 to 17.24 N/mm²) and insulating properties.
3. Concrete for Structures
Aggregates used in fully structurally efficient concrete often come from the other end of the spectrum and include things like expanded shale, clay, slates, slag, and fly-ash. You need at least 17.24 N/mm² for compressive strength.
The compressive strength of the concrete produced by the majority of structural LWC is more than 34.47 N/mm².
Insulation efficiency is reduced in structural LWC due to its much higher unit weight compared to low density concrete. Having said that, structural LWC has much superior thermal insulation qualities compared to NWC.

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www.ijasem.org
Vol 19, Issue 3, 2025

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Vol 19, Issue 3, 2025

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