# EXPERIMENTAL INVESTIGATION ON FIBER FALSE CEILING USING EPS

#### Kumar R<sup>1</sup>, Dr.M.Shahul Hameed<sup>2</sup> Suveka M K<sup>3</sup>, Varalakshmi M<sup>4</sup>

 <sup>1</sup>Assistant Professor, <sup>2</sup>Professor and Head, <sup>3,4</sup>UG Scholar Department of Civil Engineering,
P.S.R Engineering College, Sivakasi, Tamil Nadu, India.

*Abstract*: The development of construction industries provides countless benefits to the society and the people. At present situation, construction field all around the world is facing a serious problem with price of raw materials. It is also important for engineers to develop eco-friendly material, as environment is getting affected day by day by the increasing construction activities. False ceiling is the secondary ceiling of the main structure which is used to reduce the heat in summer and cold in winter. In this, Project report is prepared to show the activities and progress of the fibre based false ceiling with eps. We had tested the thermal conductivity, flexure strength and compression test of false ceiling and giving results. The best solution was obtained when the fiber based false ceiling in Thermal conductivity of the panel is 0.38 W/mK and Flexural Strength is 0.77kN and last the compressive strength of the cube is 1.57 N/mm<sup>2</sup> is computed.

# Index Terms: Cement, Glass Fiber, Eps, Flexural and thermal conductivity.

# 1. Introduction

In the past years, for the design of building, the choice was normally between a concrete structure and a masonry structure. But the failure of many multi-storied, low-rise R.C.C and masonry buildings due to earthquake has forced the structural engineers to look for the alternative method of construction. In the many high-rise buildings and multi storied structures majorly use the false ceiling to reduce the heat and also used for the decoratie purposes. It is economically efficient material to all the structures. False ceiling is used in interior design for commercial buildings. Due to versatile nature and other important features of false ceiling made it an indispensable feature for every commercial place, be it in a office or business place, or commercial complex or IT companies or a restaurant or a theatre or stadiu one can witness false ceiling. Interior design is the discipline dealing with the principles of design and construction and ornamentation of fine buildings. Effective building design requires balancing multiple objectives: aesthetics, acoustics, environmental factors, and integration with the building's infrastructure hence there arrises a need for false ceilings for better acoustics, ambience, lighting, covering service lines and for better environment impacts. It improves aesthetical appearance, provides insulation from heat, as a design element to create various shapes and curves and also used as a Construction filling material, Sound proofing and fire safety is always a factor in several industrial buildings, ceiling panels made from mineral fibers or fire-rated wood panels can be used within the construction to meet acceptable standards and ratings. Different levels of fire protection are obtained from the various types of ceiling available. The control of bio-contamination is essential in healthcare settings such as hospitals and large commercial kitchens. A ceiling with that reflects more light can reduce lighting and electricity costs. Sound absorption reduces noises and reduces reverberation with in the area covered by the ceiling. Sound proof rooms such as meeting rooms, conference rooms, etc. which require a quit environment. Modern dropped ceilings were built using interlocking panels and the only way to provide access for repair or inspection of the area above the panels was by starting at the edge of the ceiling, or at a specifically designed and then removing the panels one at completed, the panels had to be reinstalled. This process was very time-consuming and expensive. This invention helped suspended ceiling construction in which access is readily obtained at any desired location.

# 2. Experimental

# 2.1 materials

In this study, the components of False ceiling should be set by their functional role in order as follows: Ordinary Portland Cement commercially known as DALMIA cement was used, EPS (Expanded polystyrene) is produced from solid beads of polystyrene approximately 40 times the volume of the original polystyrene bead and its purchased from the market, Glass fibre is used as a reinforcing agent collected from the India mart.

# **2.2 Material Property**

**Cement:** Cement was used as binder in this study. It determine the strength and other properties of both fresh and hardened state of concrete. It constitutes about 10% of the volume of concrete mix and for the production of light weight false ceiling using OPC cement 53 grade is used.

Table1 Material Property		
Tests	Results	
Fineness	95.5%	
Specific Gravity	3.18	
Consistency	35	
Initial Setting Time	30 min	
Final Setting Time	ne 10 hr	

**EPS:** EPS is widely used in all over the world and it has many applications to prevent it. It is 98% light weight materials, 2-3% of toughness and its density of about 28-45Kg/m<sup>3</sup>.

Glass Fiber: Glass fiber is the cheapest available material in the construction industry and its low brittle when it is used in the composite form. Entrapping of air with the blocks of fibre will make them good thermal conductivity.

# 3. Mix Design

There is no guidance or standard method for proportioning False Ceiling Light Weight Panel. Because its density is based on its volume only, it is difficult to obtain an accrate measure of its density. For that we use mix ratio and the density is 1440Kg/m<sup>3</sup>.

**Mix Proporation:** 

Size of Panel	= 90cm x 30cm x 2cm
Volume of Panel	$= 0.0054 \text{m}^3$
Mix ratio	= 1:3
Weight of Cement	= 2.046Kg
Weight of EPS	= 1.48Kg

# **Table 2 Mix Proporation**

Tuble 2 Min 1 Toportution			
Trial	Cement(Kg)	EPS(Kg)	Glass Fiber (Kg)
(Fibers)			
0%	2.046	1.48	
1%	2.026	1.48	0.02
2%	2.006	1.48	0.04
3%	1.926	1.48	0.06
4%	1.966	1.48	0.08
5%	1.946	1.48	0.10

# 4. Testing of Panels

Thermal Conductivity: The thermal Conductivity is a measure of a ability to conduct heat. This test is carried under the thermal conductivity apparatus of two slab guarded hot plate of system mounting hot isolated plate by ASTM C177-97 which consists of specifications is under the range of thickness of the plate is 6mm.

Flexural Testing: The Flexural test was carried under the universal testing machine (UTM) according to ASTM D790 standards. This testing machine is under the ranges from 100kN to 300kN capacity.

Compressive Testing: The Compressive test was carried under the Compression testing machine (CTM) according to ASTM D695 standards. We can check the strength of concrete at 7<sup>th</sup>, 14<sup>th</sup> & 28<sup>th</sup> day without damaging the structure. 4. Results and Discussions

In this study, Thermal conductivity, Flexural and compressive test was investigated.

Thermal Conductivity: The thermal conductivity of the specimen was calculated by using hot guarded plate apparatus. Finally 5% of Fibers add is giving best result about ability to conduct the heat transfer from the material. Thus, thermal conductivity of the material is (K) = 0.038 W/mK.

**Table 3 Thermal Conductivity Test** 

Percentage of Fibers	Thermal Conductivity
0% Fiber	0.036
1% Fiber	0.036
2% Fibers	0.0365
3% Fibers	0.037
4% Fibers	0.037
5% Fibers	0.038



# Figure.1 Thermal Conductivity

**Flexural Strength:** Plates all passed the flexural test established according to the standard. As might be expected, the maximum breaking loads for the plates are obtained with the adding of fibers at 5% fibers is 0.77kN.

Table 4 Flexural Strength	
Percentage of Fibers	Maximum Bearing Load (P)
0% Fiber	0.6
1% Fiber	0.6
2% Fibers	0.6
3% Fibers	0.72
4% Fibers	0.73
5%Fibers	0.77



# Figure 2.Flexural Strength

**Compressive Strength:** A compressive strength of cube specimen we can find out by dividing maximum compressive load taken by cube specimen by its cross-sectional area. Thus, the maximum compressive strength of the cube is tested and value is 1.57 N/mm<sup>2</sup>.

Percentage of FibersCompressive test (Cube)0% Fiber1.31% Fiber1.32% Fibers1.343% Fibers1.464% Fibers1.525% Fibers1.57	Table 5 Compressive Strength	
0% Fiber   1.3     1% Fiber   1.3     2% Fibers   1.34     3% Fibers   1.46     4% Fibers   1.52     5% Fibers   1.57	Percentage of Fibers	Compressive test (Cube)
1% Fiber   1.3     2% Fibers   1.34     3% Fibers   1.46     4% Fibers   1.52     5% Fibers   1.57	0% Fiber	1.3
2% Fibers   1.34     3% Fibers   1.46     4% Fibers   1.52     5% Fibers   1.57	1% Fiber	1.3
3% Fibers     1.46       4% Fibers     1.52       5% Fibers     1.57	2% Fibers	1.34
4% Fibers     1.52       5% Fibers     1.57	3%Fibers	1.46
5% Fibers 1.57	4% Fibers	1.52
	5% Fibers	1.57



#### Figure3. Compressive Strength

# 5. Cost Analysis

The cost estimate of our false ceiling is considered to be the following ingredients Cement, Glass Fiber, EPS (Expanded Polystyrene). The cost of Cement (1Kg) is Rs. 10.08, cost of Glass Fiber (20g) is Rs.3.6 and the EPS is Rs.6. Therefore the total cost estimate of Fiber false ceiling is Rs. 19.68. Thus, the original cost of false ceiling with EPS sheets currently exists Rs.35. The conventional fiber based false ceiling using EPS cost is Rs. 19.68 and it is approximately 50% of cost is reduced, when compared to the ordinary synthetic based EPS. Finally cost of fiber based false ceiling currently exists greatly reduced to their original cost. So its economical in addition to useful for the construction site majorly due to its cost.

# 6. Conclusion

From this project, for the different types of materials we had to used in the fiber based false ceiling were computed the results of the thermal conductivity of the panel is 0.038 W/mK, Flexural strength is 0.77kN and Compressive strength of the cube is 1.57 N/mm<sup>2</sup> respectively. The original cost of false ceiling with EPS sheets currently exists Rs.35. The conventional fiber based false ceiling using EPS cost is Rs.19.68 and it is approximately 50% of cost is reduced, when compared to the ordinary synthetic based EPS. Further expansion of object over here project will carry out it in future in addition to finally false ceiling using EPS with fibers currently exists studied in addition to investigated.

# References

(1) Arun Solomon A et al., "Characteristics of expanded polystyrene (EPS) and its impact on mechnical and thermal performance of insulated concrete form (ICF) system", Institution of Structural Engineers (2019) 2352-0124.

(2) Pedreno-Rojas M A et al., " Eco-efficient acoustic and thermal conditioning using false ceiling plates made from plaster and wood waste", Journal of cleaner production (2017) 0959-6526.

(3) Jan Fredriksson et al., "The effect of false ceiling on the cooling capacity of passive chilled beams", Building and Environment (2009) 0360-1323.

(4) Hande Mutlu Ozturk et al., "Life-Cycle Cost, Colling Degree Day, and Carbon Dioxide Emission Assessments of Insulation of Refrigated Warehouses Industry in Turkey", Journal of Environmental Engineering (2019) ASCE ISSN 0733-9372.

(5) O. Altan DOMBAYCI et al., "Insulation of Ceiling with different Insulation materials and its Effect on energy saving", International Journal of Materials Science and Applications (2016) ISSN: 2327-2643.

(6) Zhao Jing et al., "Study on heat transfer delay of exposed capillary ceiling radiant panels (E-CCRP) system based on CFD method", Building and Environment (2020) 0360-1323.