International Journal of Research in Engineering, Science and Management
Volume 6, Issue 3, March 2023
https://www.ijresm.com | ISSN (Online): 2581-5792


# A Sustainable Construction using Filler Slab as an Alternative Technology

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***Abstract*: As all concrete in the tension zone does not increase the tensile characteristics, steel is better at withstanding tensile parts of concrete below the neutral axis than concrete is at withstanding compressive forces. Without sacrificing the structure's quality or structural integrity, this concrete is replaced with a light-weight, inexpensive, inert filler. By reducing the quantity and weight of concrete, the slab becomes less expensive, but the strength must remain the same as the conventional slab. In many of the areas, to reduce the heat impact in the building during hot weather at an economic cost, the filler-slab technology acts as an excellent thermal insulator and brings down the temperature inside the building.**

***Keywords*: tensile, compressive forces, light-weight, inexpensive, filler, strength, thermal insulator.**

## 1. Introduction

As per the annual reports of Census 2011, around two-thirds of the total Indian population cannot afford their shelter. Affordability is one major reason for people to go shelter-less. If houses can be constructed economically by using innovative techniques to reduce the consumption of materials, more people can afford to construct their own houses.

### *A. Overview of Concrete*

Concrete being is the largest consumed material in the world after water (Cement Industry Federation, Australia), is generated and used at a large scale. Ideas to reduce the usage of concrete without compromising the quality of construction will not only lead to cost effective buildings but also forces.

### *B. Overview of Filler Slab*

The main aim behind the use of filler-slab technology is to substantially reduce carbon emissions when looked at on a large scale. There are Many innovative techniques methods that are being used. This filler slab technology is one of the innovative and cost-effective technology where a dead load of the slab is reduced by replacing the concrete.

## 2. Literature Review

Use of eco-friendly microbial bricks in RC filler slabs, S. Shrihari. The same design principles as regular RCC are used to create filler slab roofs, with the exception that portion of the concrete is swapped out for an alternative material in the tensile zone. Several filler materials have been used in place of concrete.

Comparative study of conventional and partial RCC beams and slabs for flexural and shear strength, Purushothama, R. Mithanthaya. Shear failure is less well-documented in the literature, but it is quite severe in medium- and deep-beam structures as well as hollow flat slabs. So, more knowledge is needed to comprehend the impact of shear and to lessen its impacts in order to increase the effectiveness of partial beams and hollow flat slabs during construction and conserve cement.

Study on flexural behaviour of RCC slab filled with hollow roofing tile, Deepika Dinesh Akhil P.A, June 2018. The use of filling a portion of the concrete in the tension zone with less expensive alternatives results in cost reductions for roofs and floors. The equipment for the loading frame is used to test the slab's flexural response.

Cost optimization using alternative construction techniques for low height building, Hans Raj Chaudhary, 7 July 2017. Building construction costs are rising quite quickly. Materials used in construction, such as cement, steel, and brick, as well as the natural resources needed to produce them, have a significant negative impact on the environment and the state of the ecosystem.

## 3. Methodology

*Aim:* The main aim behind the use of filler-slab technology is to condense a substantial portion of concrete below the neutral axis since all concrete in the tension zone does not add to the tensile properties.

### *A. Filler Slab Technology*

On a slab, compression is on the top fiber and tension is on the bottom fiber. The concrete in the tension zone can therefore be removed if we wish to optimize the structure because it is not as necessary there. It is the secret of filler slab building. This roofing system is highly economical. Given how slabs are built on-site (in Gujarat, India), it is difficult to remove the concrete from the tension zone. As a result, we attempt to replace (partially) that concrete using a light-weight, inexpensive filler material. The filler slab construction technique is used in this case. India has adopted filler slab technology; however, a

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sizable amount of work was required to successfully promote and disseminate this technology.

### *B. Materials Selection as per Need and Design*

Material: Low-grade Mangalore tiles, Burnt Clay Bricks, Hollow Concrete blocks, Stabilized Mud blocks/ Hollow Mud blocks, Clay pots, Coconut shells, and other light-weight, inert, and inexpensive materials can be used as filler materials. These materials are laid in grids of steel reinforcement rods and then concreting/concrete topping is applied over them.

### *C. Types of Filler Slab*

There are various filler slab kinds that are frequently utilized in building. Among them are: Clay is utilized as the filler material in a filler slab of this kind. Prior to pouring concrete over the clay, it is first compacted and levelled. It is important that the clay used to build filler slabs is of high quality and devoid of contaminants. Slab of expanded polystyrene filler Expanded polystyrene (EPS) is used as the filler in this type of filler slab. The material EPS is lightweight and simple to handle and install. Moreover, it is moisture and water resistant. Vermiculite Filler Slab: The filler substance utilized in this type of filler slab is vermiculite. a vermiculite.

## 4. Results

The replacement of non-functional cement concrete with lighter filler materials significantly lowers the dead load of the slab. Also, this aids in lowering the amount of steel needed for structural components and foundations. The weight loss of over 20 to 30 percent. However, padding crossbeams do not immolate strength or continuity, if designed and erected with strict quality control. The aesthetics of the ceiling are bettered by precisely chosen patterns in the padding crossbeams.

Table 1
Material requirements of two-way filler & two-way conventional slab of size 5m x 3.5m

| Materials | Conventional | Filler |
|---|---|---|
| Cement (Bags) | 291 | 184 |
| Steel (kg) | 169 | 75 |

## 5. Conclusion

The work that is being presented is seen as a modest attempt to lower construction costs using alternative construction methods. There are numerous technology options accessible for different building construction components, resulting in economic effectiveness without compromising structural performance. It improves knowledge of the building materials that can be found in nearby resources. When all these methods are used, construction costs will go down since less materials are used, without sacrificing quality standards. Due to lower construction costs, the economically underprivileged segments of society are immediately impacted or benefited by these types of projects. The environment would be conserved if building materials like cement, steel, and bricks were used less frequently.

## References

[1] Mahananda R. K., Vikas Mendi, and R. M. Raveesh, "Design and Analysis of Filler Slab." IOP Conference Series: Materials Science and Engineering. Vol. 1006. No. 1. IOP Publishing, 2020.
[2] Acharya, Ramya R. et al., "Optimization based feasibility study for filler slabs as a response towards the ECBC roof compliance with respect to thermal transmittance for five climatic zones of India." Procedia Manufacturing 44 (2020): 213-220.
[3] Srivastava Ayush, "Filler-Slab as a Continuous T-Beam Slab (Low Cost as Well as Increased Strength)." IJSRD-International Journal for Scientific Research & Development 2.11 (2015): 2321-0613.
[4] Sinha, Subha et al., "Sustainable low-cost housing using cost effective construction technology “Rat trap bond masonry” and “Filler roof slab” in Bihar," International Journal of Engineering Research and Technology 13.7 (2020): 1780-1785.
[5] B. V. V. Reddy, "Sustainable materials for low carbon buildings." International Journal of Low-Carbon Technologies 4.3 (2009): 175-181.
[6] Shrihari S. "Use of ecofriendly microbial bricks in RC filler slabs."
[7] B. V. V. Reddy, "Sustainable building technologies." Current Science (2004): 899-907.
[8] Srivastava Manjesh, and Vikas Kumar, "The methods of using low-cost housing techniques in India." Journal of Building Engineering 15 (2018): 102-108.
[9] IS 456(2000): Plain and Reinforced Concrete.