Filler-Slab as a Continuous T-Beam Slab (Low Cost as Well as Increased Strength)

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Abstract— Shelter is amongst the three basic human needs but now-a-days, about two-third of the total Indian population do not have their own shelter. This two-third population belongs to the middle and lower income class. These people find it difficult to construct their houses at an affordable cost by using conventional construction technology. It is found in many cases that people serve their whole life constructing their own house, but fail. The mission and dream of these people can be achieved by appropriate use of cost effective and innovative construction technology. As a whole, the housing shortage of the country can be overcome within lesser funds, without compromising with the quality control and structural stability of the structure. My this work is in continuation with the paper entitled "Cost Effective and Innovative Housing Technology", presented in IJSRD Vol. 2, Issue – 6, pages 27-29. In this work I have shown the demonstration and use of Filler-Slab in building construction to reduce cost of construction as well as the dead load of the structure. This technology also aims at increasing the strength of the slab as compared to RCC slab.

Key words:

- **RCC:** Reinforced Cement Concrete is the combination of steel and cement concrete used in building construction.
- **Slab:** A large, thick, flat piece of stone or concrete, typically square or rectangular in shape.
- **RCC T-Beam:** A T-beam, used in construction, is a load-bearing structure, with a t-shaped cross section. The top of the t-shaped cross section serves as a flange or compression member in resisting compressive stresses. The web of the beam below the compression flange serves to resist shear stress and to provide greater separation for the coupled forces of bending.
- **Flange:** A flange is an external or internal ridge, or rim (lip), for strength, as the flange of an iron beam such as an I-beam or a T-beam. the horizontal part that carries the compression is termed a flange.
- **Web***:* The upright portion carrying the tension of the beam is termed a web.

I. INTRODUCTION

A. Introduction to T-Beam:

Concrete alone is brittle and thus overly subject to the shear stresses a T-beam faces where the web and flange meet. This is the reason that steel is combined with concrete in T-beams. A T-beam is a structural element able to withstand large loads by resistance in the beam or by internal reinforcements. In some respects, the T-beam dates back to the first time a human formed a bridge with a pier and a deck. After all, a T-beam is, in one sense, no more than a pillar with a horizontal bed on top, or, in the case of the inverted T-beam, on the bottom. The upright portion carrying the tension of the beam is termed a web, and the horizontal part that carries the compression is termed a flange. However, the materials used have changed over the years but the basic structure is the same.

B. Introduction to Filler Slab:

Filler slab is a variation of conventional reinforced cement concrete slab in which part of the concrete is replaced with a filler material which can be a waste material to ensure economical advantage over an RCC slab. The basic principle in a filler slab is that, considering an RCC slab of a given thickness, the concrete in the bottom half of the slab is simply dead weight and does not play a role in taking up compressive load, which is normally taken up by concrete in an RCC slab. So, this concrete can be replaced by a suitable lightweight filler material which can be accommodated in the bottom half of the slab. Since it reduces the weight of the slab by replacing concrete, savings can also be achieved in quantity of steel reinforcement without any compromise on the quality and strength of the slab. The filler materials commonly used are hollow clay burnt bricks, mangallore tiles, hollow concrete blocks, bricks, coconut shells, terracotta pots etc.

Fig. 1: Unwanted portion of concrete below the neutral axis

C. Filler Slab in Detail:

Firstly let us analyze the bottom view of a roof made by using Filler Slab technology. Fig.2 shows the bottom view of roof made by Filler Slab technology. Fig.3 shows the cross-sectional elevation at B-B. Fig.4 shows the cross-sectional elevation at A-A. These figures show the structure of filler slab when built without any use of filler material.

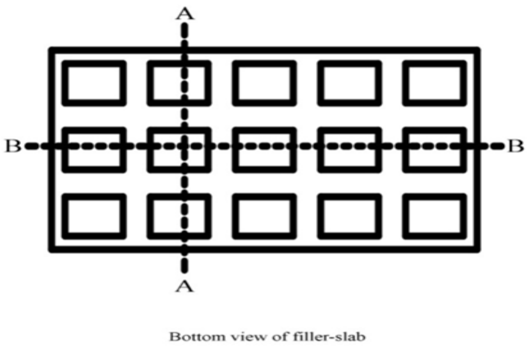

Fig. 2: Bottom view of Filler Slab

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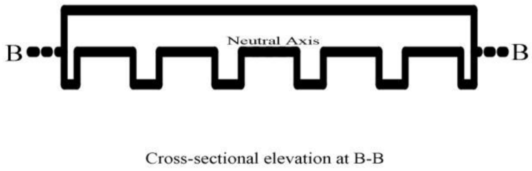

Fig. 3: Cross-sectional elevation at B-B

Fig. 4: Cross-sectional elevation at A-A

For proper analysis of these figures let us now analyze the horizontal view of the slab and represent the above cross-sectional elevations in horizontal planes. Fig.5 represents the same.

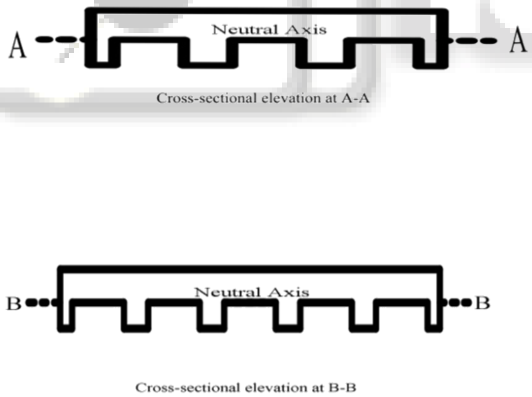

Fig. 5: Representation of cross sectional elevations in horizontal planes

It can be easily made clear that only the parts of the slab represented in the above figure are necessary for retaining the slab stresses. The portion left blank, below the neutral axis, represents the unwanted materials that are used in construction of flat typical RCC slabs. Removal of this portion does not affect the strength of the structure in any means, infact, it reduces the dead load of the structure, thereby making it bear additional loadings that can be contributed by the removal of unwanted portion of concrete below the neutral axis.

D. Filler Slab As A Network Of Continuous T-Beam:

If we analyze the above diagram, it can easily be made clear that the structure is nothing but a net framework of Continous RCC T-Beams, crossing perpendicularly. Fig.6 shows representation of Continuous T-Beams in the Filler Slab.

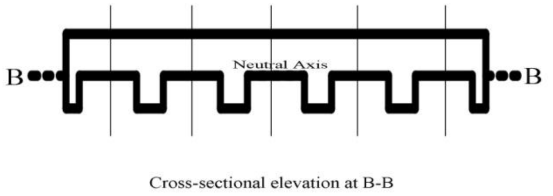

Fig. 6: Representation of Continuous T-Beams in Filler Slab

Hence, we can easily conclude that the structure so formed will be a net framework of Continuous T-Beams as shown in Fig.7.

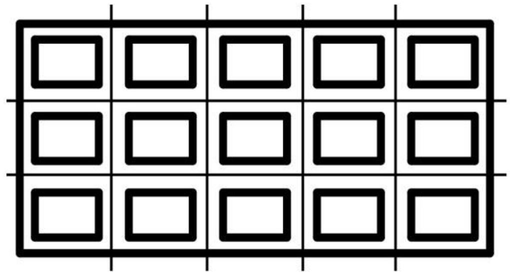

Fig. 7: Lines showing each T-Beam of the slab made of network of Continuous T-Beams

As we know that RCC T-Beams are good at resisting tensile as well as compressive stresses, this structure itself will be many times much load bearing and highly strong to bear the corresponding loads over it as compared to that of the RCC slab itself.

E. Use Of Filler Materials:

First of all let me make it clear that the structure built as per the theory explained above will itself be sufficient in bearing the desired loads (design specifications kept the same as that of RCC slab). For finishing purpose, these vacant spaces can be filled with any filler material, low at cost, locally available, minimum self load and adequate to be used as a construction material such as hollow clay burnt bricks, mangallore tiles, hollow concrete blocks, etc. After filling the spaces, the bottom view of the structure will be as shown in the Fig.8. Cross-sectional elevations at respective points are shown in Fig.9 and Fig.10.

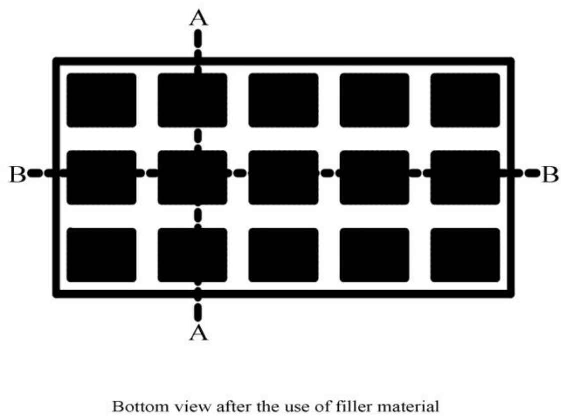

Fig. 8: Bottom view of the slab after use of filler materials

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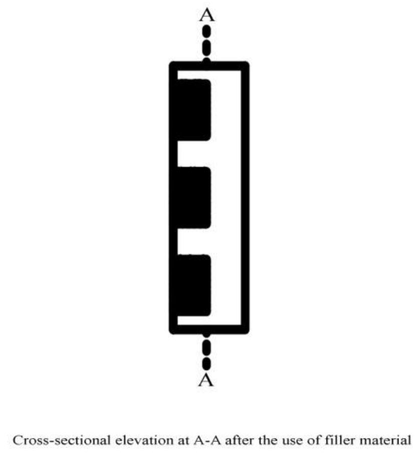

Fig. 9: Cross-sectional elevation at A-A after the use of filler material

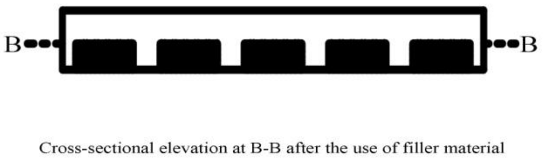

Fig. 10: Cross-sectional elevation at B-B after the use of filler material

F. *Reduction In Cost:*

It has been practically found that the total cost reduction in this technology is about 35%-40% of the cost of construction of slab as compared to that of an RCC slab.

II. Conclusion

By using the above mentioned technologies, about 35%-40% of the total cost of construction of slabs of a building can be saved without compromising its quality control and structural stability. Although, there is reduction in the use of costly building materials, the used materials are compiled in such a way that the structural strength and its durability increases as compared to the conventional RCC slabs used in building construction technologies.

III. References

[1] Paper published in IJSRD, Vol.2, Issue 6, entitled 'Cost Effective and Innovative Housing Technology', by Ayush Srivastava.

[2] Paper published in IJSRD, Vol.2, Issue 10, entitled 'Effective Use of Brick Arches, Projected Brick Arches and Brick Corbels for Reduction of Cost in Building Construction and Increase the Beauty of the Structure along with Case-Study of KAILASH KUTIR', by Ayush Srivastava.

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