Reduction in Cost of Construction of Foundation Along With Case-Study of Kailash Kutir

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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 does 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; "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", presented in IJSRD Vol. 2, Issue – 10, pages 579-581; and "Filler-Slab as a Continuous T-Beam Slab (Low Cost as Well as Increased Strength)", presented in IJSRD Vol. 2, Issue – 10, pages 293-295. After application of above mentioned construction technologies there can be a substantial decrease in the amount of materials used in construction of foundation of the structure. This work shows how we would reduce the foundation work without compromising with the strength and structural stability of the structure.

Key words: RCC, Brick Masonry, Brick Arch, Brick Corbel, Slab

I. INTRODUCTION

After application of the construction technologies like Rat-Trap bond brick masonry work; provision of brick arches, brick corbels and projected brick arches; and continuous T-Beam slab in the superstructure of the desired house, the dead load of the superstructure reduces by 30-35%. As compared to that of conventional construction technology (English or Flemish bond brick masonry work in walls, brick arches, brick corbels or projected brick arches in place of lintel beams, chhajja projections and continuous T-Beam slab in place of RCC Slab), this structure would require foundation that would have to bear less amount of dead load. Hence a substantial amount of reduction in provision of foundation can be made.

A. Rat-Trap Bond Brick Masonry Work:

It is a 9 inches (23 cms) thick, load bearing wall but in this type of wall construction, bricks are used in such a way that it creates a cavity throughout the wall height. As far as load bearing is concerned, it has 25% more load bearing capacity as compared to that of conventional English or Flemish bond brick masonry work. By using this technology, we can save 25% of total number of bricks used as well as 33% of the total mortar used. Hence, an overall of about 25-30% of reduction in dead load of the superstructure walls can be easily achieved.

B. Brick Arches:

As per the conventional construction technology, it uses RCC beams, RCC lintel beams, etc. that uses steel as well as concrete, but in our construction technology bricks and mortar are the only materials used. We know that RCC itself is much heavier than brick and mortar. Fig.1 shows the unplastered work of one of the structure constructed by using semi-elliptical brick arches. Fig.2 shows the plastered and finished work of the same structure which depicts the beauty of the structure.

Fig. 1: Unplastered Work of 'KAILASH KUTIR' Built By Using Semi-Elliptical Brick Arches

Fig. 2: Plastered and Finished Work of 'KAILASH KUTIR'

C. Projected Brick Arch:

We have used this technology to replace the lintel slabs and chhajja RCC works over the window, ventilator and door openings in the exteriors. The main work of these structures is to cover the window from top side and resist the passage of rain water to the interiors. We have used extended brick arch in place of RCC work thereby avoiding the use of reinforcement and concrete. This in turn reduces the dead load of the structure to a great extent. Fig.3 shows the demonstration of use of extended brick arch over a window opening in the building exteriors.

Fig. 3: Demonstration of Use of Extended Brick Arch over the Window Opening In the Exterior

D. Brick Corbel:

Corbels are the projections in walls to support a structure over it. Corbels can be made in a variety of shapes and by a variety of materials, but here as far as cost efficiency is concerned, we can use simple brick masonry corbels. At some places, the cantilever beam or projection can be converted into a simply supported by the effective use of corbels. This reduces the use of reinforcement, cement and concrete thereby reducing the dead load of the structure. This is highly cost effective as well as highly stable and durable because all the structural members are converted into compression zone. Fig.4 shows the demonstration of brick corbel.

Fig. 4: Demonstration of Brick Corbel

E. Continuous T-Beam Slab:

Continuous T-Beam slab is a modification of Filler slab technology. 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. Use of such materials as filler material reduces the dead load of the slab to about 25-30%

F. Foundation Used In Conventional Construction Technology:

In conventional construction technology, the thumb-rule used for calculation of width of the foundation is given by:
Width of foundation (cms) = [2T+30] cms
Where, T is the thickness of wall in centimetres.

When using 23 cms (9 inches) thick wall (English or flemish bond brick masonry work) it is found that the width of foundation comes to be 76 cms. Fig.5 shows cross section of a typical foundation in conventional construction technology.

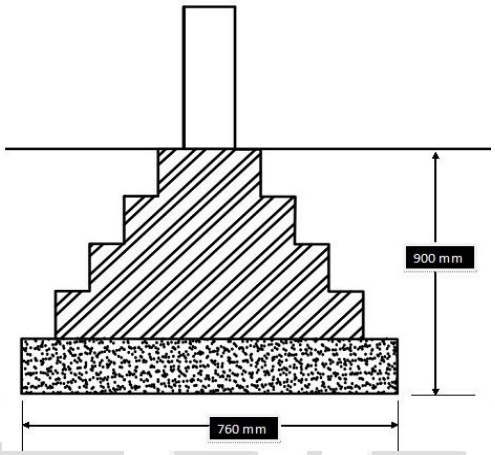

Fig. 5: Cross-Section of a Typical Foundation in Conventional Construction Technology

G. Foundation Used In Our Work:

After provision of all the above mentioned technologies, there is an overall reduction of 25-30% in the dead load of the superstructure. Hence 42 cms thick foundation is fully adequate in bearing the dead load of the superstructure. Fig.6 shows the comparative cross-section of a typical foundation used in our construction technology with that of the conventional construction technology.

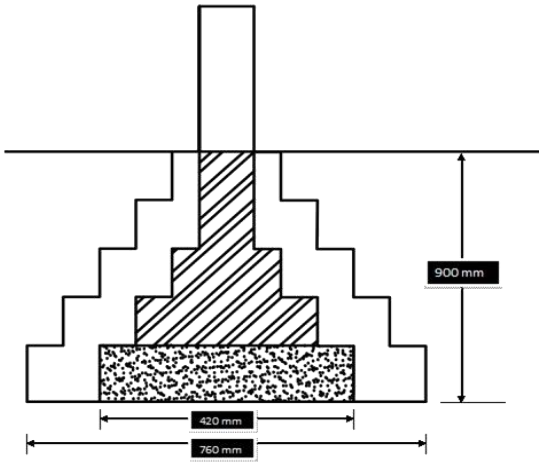

Fig. 6: Comparative Cross-Section of a Typical Foundation Used In Our Construction Technology with That of the Conventional Construction Technology

In Fig.6, it is clearly shown that there is reduction in use of materials of the foundation as compared to the conventional construction technology. Above the plinth level, the wall

built will be Rat-trap bond brick masonry work, up to a depth of about 23 cms from the plinth level, the wall will be solid brick masonry work and below the solid walls step footing would be provided that is supported by 15 cms thick CC layer at the bottom.

II. CONCLUSION

By using the above mentioned technologies, about 25-30% of the total material used in construction of foundation work of a building can be saved without compromising its quality control and structural stability. Although, there is reduction in the use of building materials, the used materials are compiled in such a way that the structural strength and its durability remain similar as compared to the conventional building construction technologies.

REFERENCES

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[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
[3] Paper published in IJSRD, Vol.2, Issue – 11, entitled 'Filler-Slab as a Continuous T-Beam Slab (Low Cost as Well as Increased Strength)', by Ayush Srivastava

