International Journal of Rural and Regional Planning Development
Vol. :1 Issue1
www.journalspub.com

New Form of Low Cost Housing – Ecoshells

*Ankur Attri**
Department of Architecture, Chandigarh University, Mohali, India

ABSTRACT
Various construction methods have resulted in the increased costs of construction in the recent years. There is a dire need of using technique which produces a form of housing to be cost effective and can sustain the climatic as well as natural factors. The use of innovative techniques, materials and bringing earth construction into use can optimally drag down the various costs which add up to the overall construction cost. Initiating the use of construction material in an innovative form like soil, cement and other energy efficiency materials which consume less energy, an outcome is easy to obtain.

Keywords: ecoshells, low cost house

***Corresponding Author**
E-mail: *ankurprabhakar05@gmail.com*

INTRODUCTION

Reforming the concepts of construction and by introducing various new techniques can bring a vital transformation in the building industry.

The knowledge of techniques which provide better structural strength while keeping the dead weight of the building much lower in comparison to a traditional building are to be used, thereby using various forms of concrete in different types of formworks. The below mentioned methods offer such example of varying use of materials.[1]

MONOLITHIC CONSTRUCTION

It is the type of construction method which forms the structure as a single unit with no joints and bonds.

Monolithic Construction can be done for buildings with more than one floor using various types of formworks, which will save time thus labor cost, cost of plaster. This technique offers more strength. When constructing a dome structure, it saves concrete and reinforcement as well.

Ecoshells

Another name of ecoshell which is a type of monolithic construction is air forming, which consists of a concrete thin shell. A high strength, high tech fabric forms the core of this technique. The shape of the fabric is created like a dome on inflation, which gives an appearance of a semi-rigid balloon (refer Figure 1).The formwork is removable and can be reused for more than 100 times.

This will reduce the construction cost especially for projects having more than one structure and such construction can withstand natural calamities such as earthquake, hurricanes etc. It is also fire resistant and termite proof.

Material saving – up to 300% of concrete and up to 400% more reinforcement is required for a conventional building in comparison to eco shell of same size. Example – New Oroville, a hi-tech hub is

constructed using these monolithic domed structures at Hyderabad covering an area of 500 acres (refer Figure 2).[2]

Fig. 1. *Construction process with formwork.*

Fig. 2. *Complete construction showing ecoshells.*

With such of construction, it is possible to have another floor for the family living in it. The unit plan will be circular in shape, space efficient accommodating all the required facilities of a living unit (refer Figure 3).

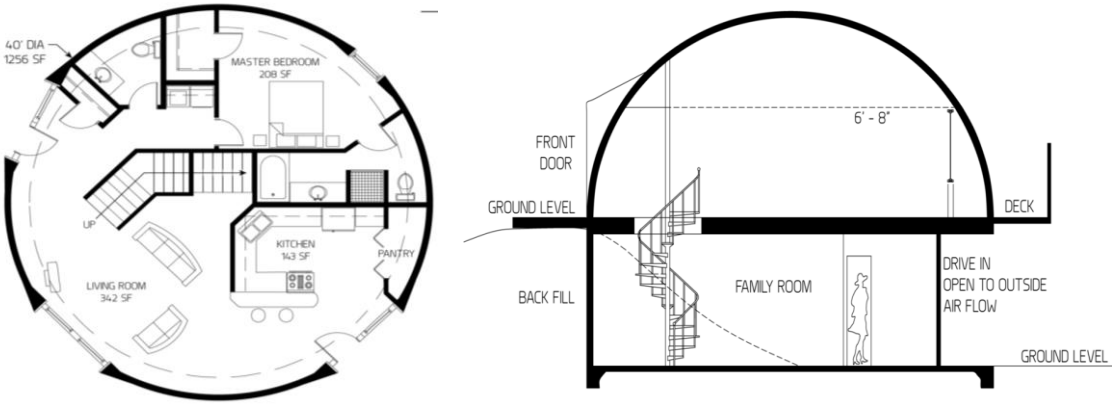

Fig. 3. *Plan showing the ground floor of an ecoshell and its section.*

This type of structure not only proves to be cost-effective, but also can sustain various loads such as earthquakes, wind pressure etc. The unit provided is efficient, enhances the speed of construction with accuracy and flexibility in construction. The whole unit is cast within a single framework thus saving time of construction and finishing as well. It will reduce the cost of plastering and can be easily painted. The services such as

electrical, plumbing, etc. are embedded before casting the unit.

Process of Construction

The land where the ecoshell is to be built is cleared and leveled within a circular form. (refer Figure 4) After the form is created with a desired diameter of the unit, steel reinforcement is laid, over which the concrete is poured to form a slab. Steel bars are fixed upright along the perimeter of the circular unit.[3]

Fig. 4. *Stages of construction showing the formation of base slab.*

Steel points are fixed over the slab to hold the formwork while inflation, which is done by using a high pressure fan smaller in size (Figures 5, 6).

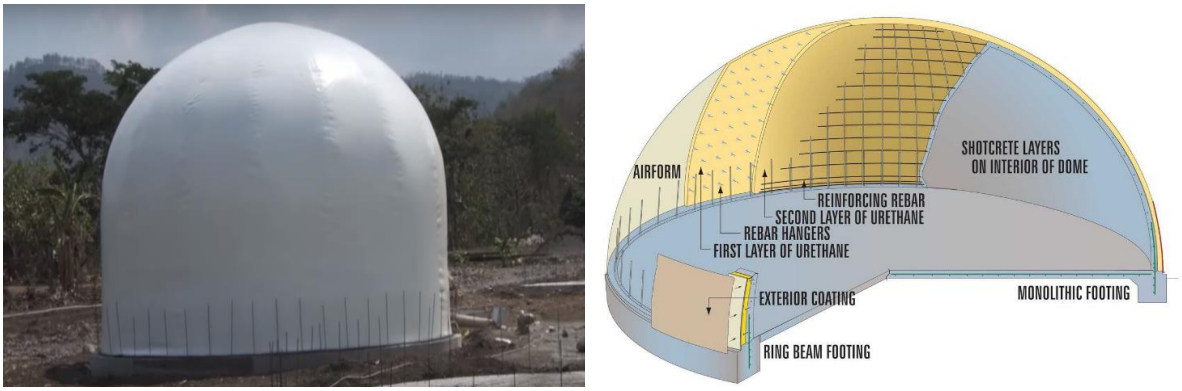

Fig. 5. *An inflated airform and the sectional details.*

After the completion of the structural framework, concrete is put or sprayed over in layers.

Fig. 6. *Fixing of steel rebars and use of concrete.*

Although the airform is inflated, steel rebars are fixed upright and bent over at the top along the inflated formwork keeping a space for the openings such as doors and windows. After the setting of concrete, curing is done over concrete to

gain strength (refer Figure 6). The inflated formwork is removed which can be used to create another ecoshell. A layer of cement slurry is applied for a smooth finish afterwards from exterior as well as interior. The structures are painted later after the completion of the construction work (Figure 7).

Fig. 7. *Ecoshells after completion of structure.*

These structures are used as residential units and other community buildings as well. Not only it adds to the aesthetics, but these are energy efficient also. A cubical structure will require 15% more energy than a spherical one having same volume. Since surface area of sphere is less than the cube, it will scatter heat slowly. Being a composite structure, the concrete maintains the temperature difference during day and night.

Example – New Orroville, Hydrabad

The construction of domes or ecoshells in Hydrabad started in 2000 by Catalytic Software, a global enterprise. The site area is 500 acres which catered 4000 ecoshells having 32 ft diameter, using the same airforms repetitively. These ecoshell structures are single storey, double or triple story as well, with 26 feet height covering a total area of 2250 sq.ft (Figures 8–10).

Fig. 8. *New Oroville Hyderabad.*

Fig. 9. *Exterior and interior view of an ecoshell.*

Fig. 10. *Ecoshells under construction.*

An Ecoshell constructed for recreation built with 240′ diameter and 70′ height, is the major focus of the whole site. The overall cost came out to be 30% less than the conventional construction.[4,5]

CONCLUSION

Due to increasing cost of construction, the traditional concepts of construction need to be reformed by introducing new techniques. The rising shortage of housing will not be catered by the conventional methods. Keeping in view the affordability of housing for majority of people, a major transformation is required which constitutes cost effective solutions for construction by applying modern construction materials and techniques efficiently or by up-gradation of conventional technologies using local resources and concepts which proves to be economic, safer and speed up the construction process.

REFERENCES

[1] Monolithic construction Technology, Sustainability in construction, Built constructions, Bangalore, January, 2016.

[2] People response to localize the imported culture, 14th World conference on Earthquake engineering, Beijing, China, October 2008.

[3] Parker F., Crandall R. An innovative architect sold on the Monolithic Dome's versatility, *Roundup J Monolithic Dome Inst*. 2001.

[4] The Hindu, 2004, Dome City.

[5] www.hildebrabdinc.com/ecoshell construction.