

Primitive Hobbit House

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Abstract- Tiny houses have become quite prominent trend in today's housing situations. They can be eco-friendly, affordable, easy to maintain and promote a slower lifestyle. There are different types of tiny houses. One among them is the hobbit house. And our project is about construction of compact structures of cross section 8*8 feet hobbit house, using primitive methods using different mixtures. Hobbit house are underground structures found mainly on the hilly regions. They are currently growing culture in the field of construction. These are basically eco-friendly as they do not damage vegetation unlike other normal buildings in hilly areas. There are many advantages on selecting the primitive method of construction as it does not require a long time, no requirement of excess men and it is 85% eco-friendly.

Keywords – Eco-Friendly, Slower Lifestyle, Hilly Areas

I. INTRODUCTION

Carrying materials to the construction site in hilly areas are difficult and in which labor demands high wages. And also using cement, sand and aggregates for constructions are not economical due to rise in rates also they are neither reusable nor eco-friendly. Hence primitive construction comes handy in these types of areas. Each building constructed using primitive technique will at-least last for an average human life time. There are many live examples such as old monuments and structures till date. These primitive buildings are constructed from renewable and biodegradable resources; hence it is eco-friendly, and it is an initiative for green buildings. Primitive construction does not require high investment, man power and reduces the construction duration. It is well suited for hilly terrain. This technique will also involve terrace and wall farming. Hobbit structures can be constructed in hilly terrain for storage purpose even in agricultural land as underground structure which will not affect vegetation.

On the other hand, materials that is used as an alternative for cement plastering and concrete such as pop, white cement, limestone, jaggery, and excavated sieved soil mixtures and the concept of using the renewable resources in construction, for examples plastic bottle as bricks. In Kodanad, a camp-site resort, "Alpas Camps and Resorts" initializes the attractive structure called hobbit house, the most popular tourist attraction, which should have an inner area of 8*8 square feet with 7.5 feet height, using innovative bonding materials as mentioned above and sized stones. The characteristics of sized stone is appreciable in such a way that it has a very high crushing strength and maintains the room temperature according to the temperature outside. This is a safe and useful initiative to use the materials available in nature for underground structure. This is because in future the usage of concrete and other materials that are in use now will make a very big impact on environment, on the other hand the increasing renewable resource can be used to avoid pollution. The primitive method involves a mixture of straws, cow dung, lime stone, jaggery, egg white and at last the excavated sieved soil but in our project as the height of the structure is minimal it is enough to use limestone jaggery and sieved soil mixture to attain the maximum strength and

workability. Since hobbit house is a kind of underground structure it involves seepage and sweating. To avoid this effect on the structure and to provide a better experience to the tourist, a hdpe sheet is provided above the roof before land filling. Then, the interior is done with pallet wood and other scarps. In brief the working procedure involves site visit, marking of the area to be excavated, excavation, foundation, rising of walls with suitable material as per client's satisfaction, erection of steel skeletal roof, ceiling process, providing a water-proofing layer and landfilling for further vegetation. The ceiling is processed in such a way that a mesh is provided over the steel structure and the plastering material along with aggregates is filled and packed with one more mesh on the top (double cover). Each plastering material has its own characteristics and construction methodology.

II. METHODOLOGY

Using locally available sized stones as wall. Soil is used as a binding material by sieving in 1.65 mm sieve and mixed with jaggery, limestone, straws, cow dung and water in the needed proportion according to the soil type. Dried coconut leaves and dry grass or HTPE sheet are used as water proofing materials and bamboo are used as reinforcement bars and hollow steel and sized stone as roofing material. Rammed earth is also an alternative primitive technique in which bamboo can be used as reinforced bars for bonding soil and small stone mixture. Reusable materials such as wooden pallets for flooring and furniture.

Coming to the bonding material each mixture has its own methodology as mentioned above in this project, we come to a conclusion that we can use 4 mixtures.

Mixture 1 - The mixture of plaster of paris, cement, white cement, and excavated sieved soil in the ratio of 3:2:1:2. This mixture does not require much quantity, as it attains maximum strength with the minimal amount of mixture used for bonding. The constituents are batched in kg's. This bonding material cannot be mixed on the whole as the mixture left unused for a time interval of 3 to 4 hours, it may dry and harden. This mixture should be mixed in little quantity, once after completely used the already mixed.

Mixture 2 - The mixture of limestone and excavated sieved soil in the ration of 1:1. This mixture is one among the primitive bonding material. This mixture requires a setting time more than 12hrs, so the mixture is mixed a day before the use and let to settle the whole night. Firstly, a small pit is formed in the site for mixing, then the water is poured into which the limestone is added, as soon as the limestone reacts with water a bubbling effect will be found. When the bubbles are so vigorous, the excavated sieved soil is added and punched continuously until it is mixed thoroughly.

Mixture 3 - The mixture of limestone, jaggery, and excavated sieved soil in the ratio of 1:1:2. This mixture is as same as the mixture 2, jaggery is added to get more stability. The procedure of mixing is also the same. The pit is formed, water is poured, limestone is added, jaggery is melted and added to the mixture and at last the excavated sieved soil is also added and punched until the mixture is mixed thoroughly. This mixture is required for a high raised wall structures to attain the maximum strength.

Mixture 4 - This mixture is the commonly used bonding mixture. The mixture of cement and M-sand in the ratio of 1:3. This is traditionally known as cement mortar.

Apart from the bonding material, there were 4 types of roof taken in consideration depending various aspects of nature and surroundings. The 4 types of roof are: flat roof, hut roof, pergola roof and pyramid roof.

III. PLANNING, BILL OF QUANTITY AND ANALYSIS

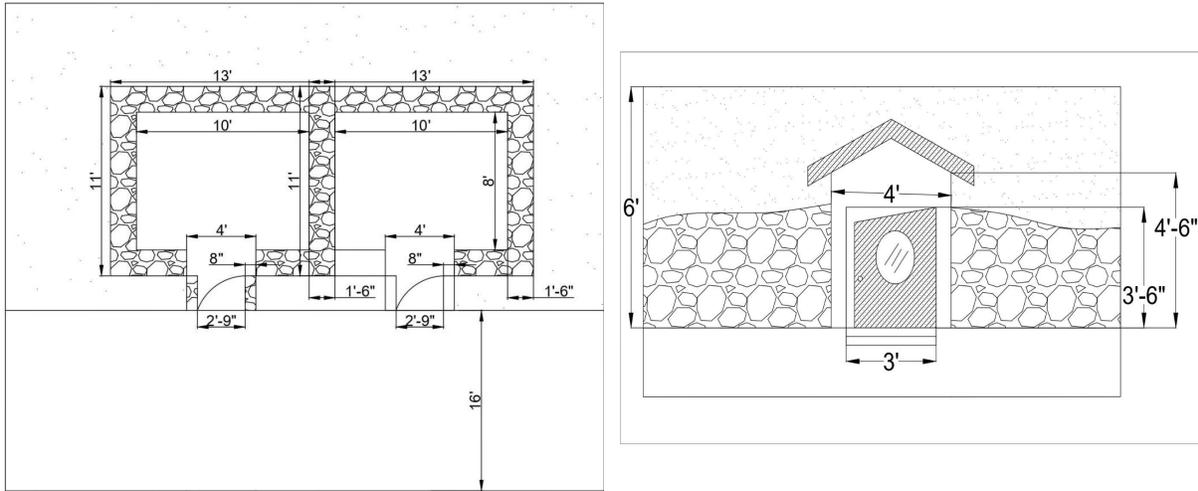


Table -1 Bill of Quantity for Roof

Roof	Steel Required in kg	Metal Mesh Sqft	GI Sheet Sqft
Pergola	165	350	200
Hut	155	200	100
Flat	102	140	80
Pyramid	165	350	200

Table -2 Bill of Quantity for Bonding Mixture

Mixture	Plaster of Paris in kg	Cement in kg	White Cement in kg	Limestone in kg	Jaggery in kg	Sieved Soil In kg	M-Sand in kg
1	300	200	100	-	-	200	-
2	-	-	-	1250	-	1250	-
3	-	-	-	625	625	1250	-
4	-	200	-	-	-	-	600

The strength & stability of the roof were analysed on Staad.Pro software and the maximum deflection for the ultimate load was found out.

Roof	Max Deflection in mm
Pergola	27
Hut	9
Flat	19
Pyramid	12

IV. CONCLUSION

After considering various factors such as budget, quantity of the materials, eco-friendly & green building concept, strength, stability, maximum deflection under ultimate load, rainfall region category and time, we come to a conclusion that pitched roof or hut roof is the best for high rainfall region as the water will not get stagnant on the roof and the mixture 1 as the bonding material as it has greater bonding strength at a less quantity of materials.

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