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Review on Amphibious Structure for Livestock's

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Abstract: India is a land of peoples who are directly and indirectly dependent on animal husbandry in a wide range from keeping a pet to warming is a primary concern today. Sea levels are rising gradually, along with more frequent and large farm husbandry.

Climate change and global severe hurricanes, flooding, heavy rain and other natural disasters. Proper counter measures are required for survival in such situations in terms of architecture. People living in low lying coastal areas are more susceptible to be affected by flooding. Disasters often occur when we are least prepared, the floods that occurred in 2018 and 2019 were suitable examples for this.

But from the past flood experience we have started concerns and preparation to face flood in the future. At present several measures are adopted in construction to construct flood mitigation structures. So far studies are conducted and several measures are adopted for human safety, but when it comes to animal safety during floods zero efforts are taken. The only option opted nowadays is to release them freely but those animals grown in a closed environment surely had to face a hard time in the time. This is not only concerned about animals but a whole society dependent on them. Our project brings out a new innovative idea named amphibious structure for livestock. Here we are adopting the idea of a pontoon based foundation which can freely lift or float over water surface along a set of pillars. Stability of the body is attained by correction of center of gravity. This project also includes a system for hazardous time feeding and waste management system

Keywords: Vertical Integrated farming, Amphibious Structure, Pile foundation Drum Pontoon, Steel Pontoon, Polycarbonate pontoon

I. INTRODUCTION

Due to increased global warming and variation in climatic conditions the occurrence of flood is common nowadays. The increase in rainfall leads to the rise in sea level, as a result water takes its own path and causes severe damages to all sectors of human life. Considering the case of kerala, a few years back the state was not actually bothered about global warming and changes in climatic conditions. But the flood that occurred during the last two years, August 2018 and August 2019 lead us to think about the above factors. The 2018 flood caused damages worth 31000 crore and killed 453 persons. Similarly the 2019 flood also created huge damages.

As a result of the previous floods the humans are somehow prepared to resist the effects of flood. But the safety and conditions of animals are least considered during the time of a flood. The animals suffer a lot during such conditions and may lead it to the death of them. According to the previous year flood history the animal husbandry and dairy sector was awfully affected. In areas like Kuttanad the primary source of income for the majority of farmers are from animal husbandry. The result of the flood hindered the source of income of farmers.

According to Hindu Business Line 800 cr was the estimated loss in the animal husbandry sector. The flood resulted in the loss of about four lakh of poultry and lakhs of goats, cattle, pigs etc.

Considering the safety of animals during floods and to decrease the loss caused to farmers we are proposing a structure which can resist flood and also facilitating integrated vertical farming. The concept of vertical farming is very useful for farmers who have only less area for farming. According to this concept a farmer can effectively utilize his small piece of land and also earn maximum profit by doing so.

The structure consists of a three story and has the shape of truncated A. Each story can be utilised for dedicated animals with heavy animals such as cows on the ground floor, climbing animals like goats on the middle floor and top floor can be used for aviary or hatchery. When you submit your paper print it in two - column format, including figures and tables. In addition, designate one author as the "corresponding author". This is the author to whom proofs of the paper will be sent. Proofs are sent to the corresponding author only

II. AMPHIBIOUS MINI FARM

A. Objective

Amphibious mini farms propose a new method of livestock farming mainly focused on flood prone areas as well as low land areas. The aim of the project is to promote livestock farming to everyone. This project brings a revolutionary change to the usual concept of large land required for starting a farm to comprehending it to a small plot. The project aims to produce maximum profit from minimum pieces of land.

B. Vertical farming

The development of technologies has also reflected in the field of agriculture. New and innovative methods are replacing the old techniques everyday. Several methods are available for efficiently utilising land space for farming. Farm planning is a major task and its very hard to make it profitable. So each and every step must be very careful from planning. The farmers who have not enough land for farming different animals can use this method and thereby increase the revenue. Vertical farming of animal husbandry can be termed as setting up animal farms on a building or structure in layer above layer. Here layer corresponds to storeys of building. Each storeys should be constructed with all the requirements for the corresponding animals

The design is in such a way that it has the shape of A with its top corner made flat or has a truncated A shape. The A shape structure is more stable that we are adopting this shape. The structure is made up of Steel section and has three floor. The ground floor can be used for dairy farming, the first floor is designed for climbing animals like goats, rabbits etc and the top floor can be used for hens or other birds. Waste management is one of the important factors to be considered while designing such a structure. Efficient and timely management of waste is ensured by suitable machineries or by manual means. It will not only help the owner or farmer to utilise the space but also to rely on one field when the other is dim. The initial capital for the farm will be more but in the long run it will definitely become an asset for the owner. Introducing an amphibious foundation to this structure will result in an innovative product in the field of agriculture and will wipe off the limitation of constructing a farm on a swampy field or waterlogged regions.

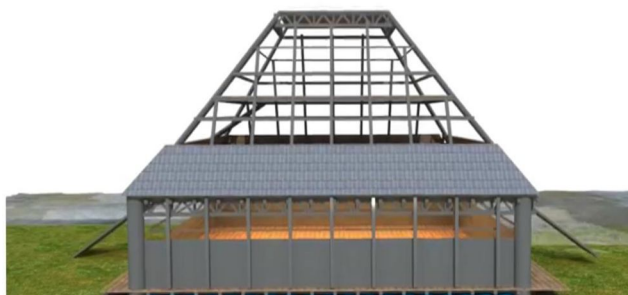


Fig 1: Vertical Farming or Superstructure Model

C. Amphibious Structure

An amphibious structure generally includes a light weight superstructure which rests on a floatable foundation. For creating an amphibious structure for integrated farming stability and strength is a major concern. The structure is completely built on steel. The foundations that can be adopted for the structure are polycarbonate foundation, drum foundation and steel foundation.

1) *Drum Pontoon:* Foundation made up of steel frames tightly packed with drums. Number of drums required for stable floating of structure is found by calculating weight that one drum can carry and equating it to the total load of superstructure. Since high void space is present between drums, the size of the structure is big. Drum foundation is economically optable.



Fig 2: Drum Pontoon based foundation

- 2) *Polycarbonate Pontoon*: The foundation or pontoon is made using a plastic mix polycarbonate sheet fixed over a frame made up of steel sections connected by means of rivets or gum. This method can be adopted for heavy structures as void space is the minimum height of the pontoon required is calculated by using the equation, $\text{Mass} = \text{Density} \times \text{volume}$, where density is assumed to be that of water.

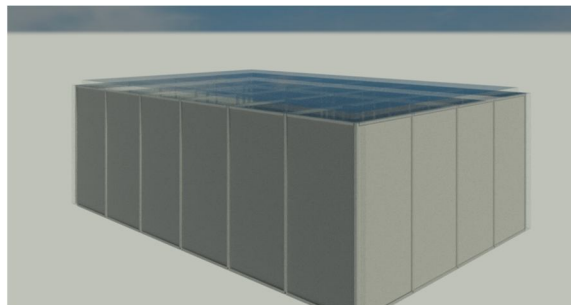


Fig 3: Polycarbonate Foundation Model

- 3) *Steel Pontoon*: Pontoon made completely using steel sheets and steel section this method can be adopted for heavy structure near to rivers and where flow is high. Height of pontoon is found similar to that of polycarbonate foundation



Fig 4: Steel Pontoon

D. Foundation

This includes 2 types of foundation : Pile foundation and isolated footing.

Pile foundation is given to resist the horizontal movement as well as to aid in upward lift of the structure.

Isolated footing is given to transfer the load in resting condition when the structure is not floating

Pile should be long enough to touch the stable soil beneath and to transfer the load safely to soil. Each pile is made up of two steel pipes. The bottom pipe will be hollow and will reach the required depth and the top pipe will be inserted into the bottom and locked at appropriate depth. The locking is done for the stability of the structure during the lifting process. Friction between two pipes can be reduced by providing bearings. In general conditions pile caps are provided above piles and here RCC (reinforced cement concrete) is provided between top of pile and bottom of steel frame foundation. This will help to transfer load and it connects foundation and pile.

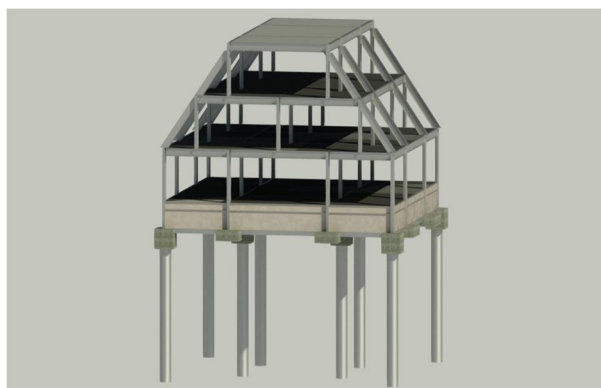


Fig 5: Amphibious Vertical Farming Model

E. Advantages and Limitations

The farmers who lack land for farming can adopt this method and can earn a good revenue. Swampy land or uncultivated paddy fields can be utilised for farms. It is an innovative idea in the agriculture field and by proper plans followed by proper execution it will attract large entrepreneurs. If large entrepreneurs invested capital on such farms it will not only bring maximum profit from small land but also provide daily jobs for small daily workers.

Now when it comes to its limitations, as it is a steel structure the construction cost will be more than an ordinary farm. The cost cannot be reduced due to the necessity of strength for the structure since it is three storey. This amphibious farm will be hard for small farmers to afford.

III. CONCLUSION

The amphibious structure for vertical integrated farming is a flood resilience method that can be adopted by the livestock farmers. The concept of integrated farming generates more profit from less area. The adoption of amphibious construction technique to this farming methodology makes sure that the farmers are least affected during the time of flood. This method encourages more people towards animal husbandry and also promotes livestock farming in water logged areas.

The truncated A shaped superstructure with three storeys provides space for three different types of livestock farming. This feature makes this design a more profitable venture. As steel tubes are used for the construction of superstructure, it is able to undertake the huge load imposed by the animals. The roofings provides shelter to the animals during rain.

The maximum live load occurs at the base of the structure and minimum at the top, this ensures the stability of the structure during the time of rising. As the structure is stable the movement of animals is not restricted even during flooding time. The waste is removed using flexible pipes, so that it is not disturbed during the rising period. The effective waste management methods adopted helps to provide a clean living atmosphere for the animals.

The adopted Drum foundation facilitates the rising of the structure during the flooding time. As the foundation is made of plastic drums, self weight is less and also the construction cost can be reduced compared to steel foundations which have more load carrying capacity but not adoptable from an economic point of view. The alignment of the Centre of Gravity of the superstructure along CG of foundation results in a structure that is free of overturning.

During normal conditions, the structure is made to rest on a Pile foundation. The height of the pile is dependent on the superstructure weight and height up to which the structure is to be raised during flood.

Kerala is a state in which floods occurred in consecutive years. A huge percentage of people in the state is dependent on animal husbandry and the estimated loss that occurred during flood in this sector is 800 crores. So in such a situation the idea of vertical integrated farming equipped on an amphibious structure is of high significance.

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