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Analysis to Convert Traditional Building into Green Building

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***Abstract*—The term "Green Building" is not just applicable to products, but also to the construction strategies, building design, orientation, landscaping, building operations, maintenance etc. Lessen the impact of a building on human health and environment, the more green it is. In the present study, the existing construction of our institute has been studied in terms of efficient use of resources and energy. The overall consumption of electricity and water has been determined and the energy and water that will be saved after the additional inputs (like rain water harvesting system, vermicomposite plant) to improve the efficiency of the building have been also computed. The construction and installation charges have also been calculated. The study concentrates on the advantageous outcomes once the building is converted to "green building".**

***Index Terms*—green building, segregation, vermicomposite plant and rain water harvesting.**

I. Introduction

A green building may be understood as an outcome of the design philosophy focusing on increasing the efficiency of the resources used - i.e.: energy, water and material – along with reduced hazards on environment and human health. This can be achieved through better design, construction, operation, maintenance etc. The green building should be designed and operated in such a manner that it reduces the impact on human health and environment by:

1. Use of energy, water and other resources in an efficient manner.
2. Minimizing health hazards of the occupants.
3. Minimizing pollution, waste and environmental degradation.

Green building (also known as green construction or sustainable building) refers to both a structure and the application of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance, renovation, and demolition. The green building concept is gradually gaining momentum in India. A green building typically applies practices like harvesting energy and water and using environmentally friendly materials in its design, construction, operation and maintenance and sustains the environment. Development of green buildings has many monetary benefits such as low energy, waste disposal, water cost, and low environmental and emission costs. Increasing urbanization and consequent rise in the generation of solid wastes in cities has made solid waste management an important area of concern. And there are many ways to process the waste but the best way is composting, since it is the easiest method. The advantages and benefits of the green buildings are spread out over the life span of the building and should be looked at in the long run and not on the initial cost.

II. Objective

As per the study conducted on the SDPS Women's College, Indore campus many of the parameters were found existing in the building. But it was found that certain aspects were not fulfilled like: rain water harvesting, efficient solid waste maintenance. Hence following objectives are drawn:

1. To determine the annual water consumption of main college block.
2. To determine the annual average water harvested by the rain water harvesting system.
3. To suggest a suitable method for solid waste decomposition.

III. Methodology

The following methodology has been adopted in the present study:

1. The overall annual water consumptions of main block has been obtained.
2. The catchment area of the building has been measured.
3. The amount of water that can be recharged/ regained with the help of rain water harvesting has been calculated.
4. Provisions for tube well rain water harvesting system have been provided.
5. The amount of waste generated in campus has been obtained.
6. Vermicompost pit has been designed as per the requirement.

IV. Provisions

A. Provision for Ground Water Recharging System

In the present scenario, the total consumption of water in

main block of SDPS Women's College is 3,600 cu.m/year and the fulfillment of this quantity is done by tube wells which are leading to the depletion of ground water level. Hence there is an urgent need for provision of ground water harvesting system.

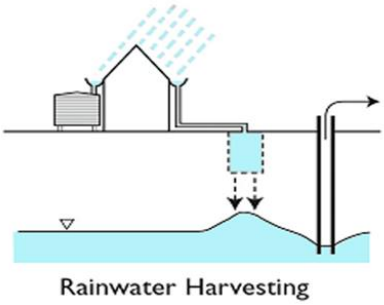

Fig. 1. Rain water harvesting

B. Provision for Vermicomposite Plant

As there is a mess present in SDPS Women's College and a large amount of kitchen waste is generated every day. Proper and efficient kitchen waste management necessitates the incorporation of following points:

1) Reduction.
2) Segregation.
3) Disposal.

1) Reduction

The first step for efficient kitchen waste management is to reduce the same at the time of generation of waste. For this purpose, posters should be designed for encouraging the students regarding the importance of food and not to waste it.

2) Segregation

The next step is the proper segregation of kitchen waste as bio-degradable and non-biodegradable, and the responsibility of segregation of wastes stands on the shoulders of maidservant. Maidservant washes the utensils twice in a day. She is asked to follow the following program for washing the utensils. Follow up is also done to ensure that washing is done as per the program:

1) Remove all large sized solids (e.g. big pieces of vegetable, empty milk packets etc.) by hand picking.
2) Wash all the utensils with plain water to remove the adhered food materials. This is concentrated wash.
3) Apply soap solution to utensils.
4) Wash with water to remove soap.
5) Rinse with water.
6) Washing powder is used only for frying pan and hot pan.

3) Disposal

Now for the proper disposal of the kitchen waste management, Vermicomposting plant suits the most in the institute building as in return, high value manure is also obtained.

V. Calculations

A. Percentage of Water Conserved through Rain Water Harvesting

Total water consumed in a day =18,000lit/day
(As per data collected)
= 18cum/day
Total working day = 200
Total water consumed by the building = 3,600 cum/year
Average rainfall = 1.016m

Area of roof from where water is to be collected:

Calculated from the plan of existing central block of SDPS College.
Area of college building = 721 sq.mt.
Area of open space = 93 sq.mt.
Total covered space = 628 sq.mt.
Total runoff = catchment area x runoff-coefficient x rainfall
= 628 x 0.8 x 1.016
= 510.43 cum
% of water saved = 510.43/3,600 x 100
= 14.18 %

B. Cost of Rainwater Harvesting System

The total cost of the rainwater harvesting system is tabulated below:

TABLE I
Cost of Rain Water Harvesting System

Particulars	Figures
The overall construction cost of the water harvesting system including all services for pit size L=2M, B=3M, D=3M is	Rs. 65,000

C. Design of Vermicomposite Plant

(As per the Data Collected)
Assuming total design load taking future expansion into consideration:
Total waste discharged = 875kg/week or 125kg/day
(Say130kg/day)
Taking loading @40kg/m²
Thus area required = 130/40 = 3.25m²
Providing L: B as 1:2
L/2 x L = 3.25
L² = 6.5
L =2.5
Thus B = 1.25
Thus bed dimension = 2.5 x 1.25 m.
In order to take care of 30 days cycle we will have 10 beds each of 2.5 x 1.25 m.

a) The garbage will be deposited in three layers 75 mm thick overlaid on a layer of earthworms, Vermi casting powder and cow dung soil of thickness 200 mm.
b) Thus on every bed there will be three layers of garbage covered by three layers of soil.
c) This will make a total depth of 0.85 m.

d) Taking 6kg of earthworm to be provided in each bed of 2.5x1.25 m.
e) The total earthworm required will be = 6 x 10 = 60 kg roughly 6000 earthworms namely dioscorea villesa.

D. Cost of Vermi Composite Plant

The cost required for vermin composite plant is tabulated below:

TABLE I
COST OF VERMI COMPOSITE PLANT

Particulars	Figures
Total cost of excavation	Rs. 1608.00
Total cost of construction	Rs. 1,13,595.00
Total	Rs. 1,15,203.00
Add miscellaneous and contingencies @ 5%	Rs. 5,750.00
G.Total	Rs. 1,20,953.00
Cost of Earthworms	Rs. 24,000
Total	Rs. 1,44,953.00

VI. CONCLUSION

The following conclusions are obtained from the present study:

1. The total quantity of water harvested after construction of water harvesting system is found to be 510.43cub m/year which is about 14.18% of the total annual water consumption.
2. The overall construction cost of the water harvesting system is found to be Rs. 65,000.
3. For solid waste disposal vermicomposite plants of dimension 2.5 X 1.25m and 10 numbers are suitable for 30 days cycle.
4. The total construction of vermin composite plants is found to be Rs. 1, 44,953.

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