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RESEARCH ARTICLE

PROPOSAL OF SITE PREPARATION OF GREEN GUEST HOUSE IN MES COLLEGE CAMPUS BASED ON LEED RATING

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ABSTRACT

The sustainable development of construction sector has become very significant in the last decade. The reason behind this is resource consumption and impacts generated by the buildings. Green buildings have the potential to minimize the negative impacts on the environment and can offer healthy life to both occupants and construction employees. Green rating systems such as United States Green Building Council's Leadership in Energy and Environmental Design (LEED) are leading to changes in the way owners, designers and contractors approach to the design, construction and operation of the building. This paper endeavors the site selection and planning of a green guest house constructed according to LEED rating system.

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INTRODUCTION

A green building is one, which in the process of constructing building, uses renewable materials, saves money on electricity, gas and water bills. This method can include using all natural materials but for the most part, it pertains to saving environment and costs. Green building refers to a structure and using process that is environmentally responsible and recourse efficient throughout the building life cycle from sitting to design, construction operation, maintenance, renovation and demolition. The green building concept is catching up fast globally, in India too. The common objective of green building is to reduce the overall impact of the built environment on human health and natural environment by:

1. Efficiently using energy, water and other sources
2. Protecting occupant health and improving employee productivity
3. Redusing waste, pollution and environmental degradation.

LEED is the most popular green building certification program me developed by USGBC. Which include a set of rating systems.Buildings can qualify for four levels of certification:

1. Certified: 40-49 points
2. Silver: 50-59 points
3. Gold: 60-79 points
4. Platinum: 80 and above

Site details

The site selected for the project is at MES campus, Thrikkannapuram, Malappuram district Kerala. It is a 4410 m^2 plot area with proximity services like grocery store, schools, shopping, college, entertainment and transportation. The site is located along Nila, hence it provides a beautiful view and a

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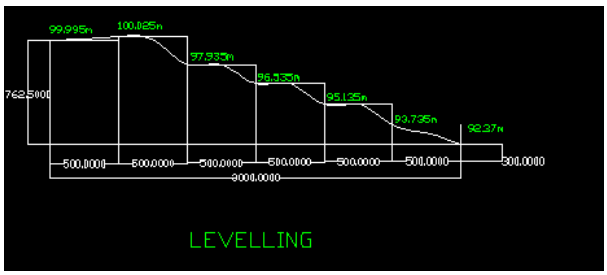
comfortable living environmsent. The site is located in the residential zone. The residence is planned according to the zoning regulations of the local government. It is about 450 m from the main road so that the delivery vehicles and construction equipment will drive on to the Plot through. The soil is very fertile and has thick vegetation. The site has a close proximity to the basic utility services like electricity, tele-communication, water supply, and community sewer system. Here is a Google map showing location of our site.

METHODOLOGY

1. Conducted a engineering survey on the specific site. And we found the slop of the land. The result of the survey is given below



2. Found irrigation demand for the specific site

Method for Calculating Reduction in Irrigation Demand
Step 1. Calculate the baseline irrigation water usage:

Baseline Usage = Landscaped Area * ET0 * 0.62
Where ET0 = Baseline Evapotranspiration Rate (available from local and state Departments of Agriculture).

Landscaped area = 2740m²
ET0 =7mm/day.
Baseline Usage =2740*7*0.62
=11891.6

Step 2. Calculate the design case irrigation water usage:

Design Case Usage = (Landscaped Area * ETL ÷ IE) * CF * 0.62

Where ETL = ET0 * KL and KL = KS * KMC, for Values for IE use as specified in tables below. For CF, use estimated value based on manufacturer's specifications for percentage water savings

Table 1. Species Factor

Vegetation type	Species factor (KS)		
	Low	Average	High
Trees	0.2	0.5	0.9
Shrubs	0.2	0.5	0.7
Groundcover	0.2	0.5	0.7
Turf	0.6	0.7	0.8

(Source: LEED For Homes Manual 2008)

Table 2. Microclimate Factor

Example microclimate impacts	Microclimate factor (K_{MC})		
	Low	Average	High
Shading	0.5	0.8	1.0
High sun exposure	1.0	1.2	1.5
Protection from wind	0.8	0.9	1.0
Windy area	1.0	1.2	1.5

(Source: LEED For Homes Manual 2008)

Table 3. Irrigation Efficiency

Irrigation type	Irrigation efficiency (IE)	
	Low	High
Fixed spray	0.4	0.6
Impact and microspray	0.5	0.7
Rotors	0.6	0.8
Multistream rotators	0.6	0.8
Low volume and point source (e.g., drip)	0.7	0.9

(Source: LEED For Homes Manual 2008)

KS=0.9
KMC=0.8
KL =0.9*0.8=0.72
ETL =7*0.72=5.04
IE =0.9
CF =0.8

Design Case Usage = [(2740*5.04)/0.9] * 0.8 * 0.62
= 7610.624

Step 3. Calculate the percentage reduction in irrigation water usage:

Percentage Reduction = (1 – Design Case Usage ÷ Baseline Usage) * 100

= [1-(7610.624/11891.6)] * 100
=36%

Step 4. Refer to Table, above, to determine points earned

Analysis

LOCATION AND LINKAGE (LL)

1 LL2: SITE-SELECTION

Intent

Avoid development on environmentally sensitive areas.

Requirements

According to LEED-H don't construct building's on site of prime soils or soils of state significance, previously undeveloped land, habitat of any species, within 100 feet of any wetlands, previously undeveloped land that is within 50 feet of a water body defined as seas, lakes, rivers, streams and tributaries, land which prior to acquisition for the project was public parkland.

Verification / Submittals

The site doesn't belong to any of the above mentioned areas. It is a residential zone. The requirement for LL 2: Site Selection is satisfied and hence achieved 2NTS 2points.

2 LL4 : INFRASTRUCTURE

Intent

Encourage building of LEED homes in developments that are served by or are near existing infrastructure (i.e., sewer and water supply)

Requirements

According to LEED-H select a lot within 1/2 mile of existing water service lines and sewer service lines. Since the lot is within the residential zone and hence ½ Mile of these services are available within the proximity Of the Site the credit for LL 4: Infrastructure is achieved and Hence attained 1 point.

Verification / Submittals

According to LEED H this must be done by inspection by concerned person itself.

3 LL5: Community resources/transit

Intent:

Encourage building of LEED homes in development Patterns that allow for walking, biking, or public transit (There by minimize dependency on personal automobiles and their associated impacts).

Requirements:

According to LEED-H select a site within ½ (804.67200 Meters) mile of 4 basic community resources specified in Table below

- ❑ Arts and entertainment center
- ❑ Bank
- ❑ Community or civic center
- ❑ Convenience store
- ❑ Daycare center
- ❑ Fire station
- ❑ Fitness center or gym
- ❑ Laundry or dry cleaner
- ❑ Library
- ❑ Medical or dental office
- ❑ Pharmacy
- ❑ Police station
- ❑ Post office
- ❑ Place of worship
- ❑ Restaurant
- ❑ School
- ❑ Supermarket
- ❑ Other neighborhood-serving retail
- ❑ Other office building or major employment center

Note: Up to two of each type of community resource may be counted. For example, two restaurants within ¼ mile may be counted as two community resources; four restaurants also count as two.

(Source: LEED for Homes manual 2008)

Verification / Submittals

Since the site is provided with Bank, Fitness center, Laundry, Library, Pharmacy, Post office, Place of worship, Restaurant, school within half mile and the credit LL 5: Community resources/transit is attained **(1 point)**.

Sustainable Sites (SS)

1 SS1: SITE STEWARDSHIP

Intent

Minimize long-term environmental damage to the building lot during the construction process.

Requirements

1.1 Erosion Controls during Construction. Prior to construction, design and plan appropriate erosion control measures. During construction, implement these measures. Erosion control measures must include all of the following:

a) Stockpile and protect disturbed topsoil from erosion (for reuse).
b) Control the path and velocity of runoff with silt fencing or comparable measures.
c) Protect on-site storm sewer inlets, streams, and lakes with straw bales, silt fencing, silt sacks, rock filters, or comparable measures.
d) Provide swales to divert surface water from hillsides.
e) If soils in a sloped area (i.e., 25%, or 4:1 slope) are disturbed during construction, use tiers, erosion blankets, compost blankets, filter socks and berms, or some comparable approach to keep soil stabilized.

Since we would provide swales to prevent storm water, I achieved 1 point.

2 SS2: LANDSCAPING

Intent: Design landscape features to avoid invasive species and minimize demand for water and synthetic chemicals.

Requirements

2.1 No Invasive Plants: Introduce no invasive plant species into the landscape.

2.2. Basic Landscape Design (2 points).

Meet all of the following requirements for all designed landscape soft capes:

a) Any turf must be drought-tolerant.
b) Do not use turf in densely shaded areas.
c) Do not use turf in areas with a slope of 25% (i.e., 4:1 slope).
d) Add mulch or soil amendments as appropriate. (Mulch is defined as a covering placed around plants to reduce erosion and water loss and to help to regulate soil temperature. In addition, upon decomposition, organic mulches serve as soil amendments. The type of mulch selected can affect soil pH.)
e) All compacted soil (e.g., from construction vehicles) must be tilled to at least 6 inches.

All the following requirements are satisfied by introducing drought tolerant plants. Drought tolerant shrubs commonly available are glossy abelia, white forsythia and century plant. They can be exposed to sun and partial shade (fig4.1). Hence 2 points are achieved.

(Source:www.google.com)

Fig.1. Glossy abelia, White forsythia and Century plant

Reduce Overall Irrigation Demand by at Least 20% (maximum 6 points, as specified in Table)

Intent:

Design the landscape and irrigation system to reduce overall irrigation water usage. The estimates must be calculated and prepared by a landscape professional, biologist, or other qualified professional using the method outlined below.

Table 4. Reduction in water demand

Reduction in estimated irrigation water usage	SS 2.5 points	WE 2.3 points	Total points
20–24%	2	0	2
25–29%	3	0	3
30–34%	4	0	4
35–39%	5	0	5
40–44%	6	0	6
45–49%	6	1	7
50–54%	6	2	8
55–59%	6	3	9
60% or more	6	4	10

(Source: LEED For Homes Manual 2008)

Since the percentage reduction is 36% I have earned 5 points.

Permanent Erosion Controls (1 point):

Plant one tree, four 5-gallon shrubs, or 50 square feet of native groundcover per 500 square feet of disturbed lot area (including area under roof). Since we are planting a number of trees and also providing a native ground cover with grass, trees for 2250m² and hence we have achieved **1 point**.

Table 5. Permeable Area

Percentage of buildable lot (excluding area under roof) that is permeable	Points
70–79%	1
80–89%	2
90–99%	3
100%	4

(Source: LEED For Homes Manual 2008)

4 SS4: SURFACE WATER MANAGEMENT

Intent: Design site features to minimize erosion and runoff from the home site.

Credit:

4.1 Permeable Lot (maximum 4 points, as specified in Table 5.5)

Design the lot such that at least 70% of the built environment, not including area under roof, is permeable or designed to capture water runoff for infiltration on-site. Area that can be counted toward the minimum includes the following:

a) Vegetative landscape (e.g., grass, trees, shrubs).
b) Permeable paving, installed by an experienced professional. Permeable paving must include porous above-ground materials (e.g., open pavers, engineered products) and a 6-inch porous sub base, and the base layer must be designed to ensure proper drainage away from the home.
c) Impermeable surfaces that are designed to direct all runoff toward an appropriate permanent infiltration feature (e.g., vegetated swale, on-site rain garden, or rainwater cistern).

Since we are providing vegetative landscaping and permeable pavements we have achieved 4 points.

Conclution

Although building home is a necessary component of society, a green design recognizes that construction of any type adversely affects the natural environment. The first real step toward a green home must begin with proper planning and a design that includes a holistic approach to providing shelter within in the confines of a fragile natural environment. Site selection is the first and most critical step in building a green home. The location, orientation and landscaping of a home building project all effect the local population, environment, regional transportation, and energy use. Erosion control, soil care, landscaping, and the potential for gray water usage are essential to consider when planning a green home design. For site preparation of green building guest house according to LEED rating system I got 16 points.

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