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OPTIMIZATION THE DAY LIGHTING IN HIGH RISE BUILDING TOWARDS IN GREEN BUILDING CONCEPT

Dr. Ganeswaran, B.Srinivasan
Associate Professor, Karpagam University, Coimbatore, Tamil Nadu, India.
Research Scholar, Karpagam University, Coimbatore, Tamil Nadu, India.
Department of Civil Engineering

ABSTRACT: Civil engineering is a professional and arguably with the base of engineering protocols. Day lighting is an important issue in construction management and modern engineering architectures. Daylight affecting the functional arrangement of spaces, occupant comfort, structure and energy use in high rise buildings. Daylight is well thought-out as the most excellent source of light meant for good colour rendering along with its quality is the one lighting source to matches human visual response. A lot of advanced techniques are generated and implementing for utilize the sunlight source entirely, for reducing artificial light source in day time. This research started their journey through green computing for environmental friendly approach. Plastics are dangerous one and increasing their products in the world without major reusable way and with small time span use, after that same plastic once again coming to reproduce or non-reproduce. Plastic boards are using in constructions to increase reflecting sunlight source with reflecting coating. At the same time the concrete mix as well reduces for each plastic board size, with the intention of saving water, sand and cement.

KEYWORDS: Green computing, sun light, reflection, high rise building, plastic boards, reflection coating.

1. INTRODUCTION

The Natural Daylight penetration into an individual high rise building units' plays a significant role in high rise residential building designs. A lot of factors determine the daylight quality within the housing units. A qualitative appraisal of the lighting quality in individual rooms of the housing unit is to be done by its occupant. This is combined with a quantitative daylight simulation for the residential units showing the distribution of lighting within the spaces. The distribution of lighting quality significantly varied across the building types and spaces or rooms within the individual units. In our research we have used daylight inside the high rise buildings with low expensive, environmental friendly, reducing other construction materials as well. Consequently the green building concept has been selected for utilizing the sunlight source into high rise buildings.

Green building has a major responsibility and protocols with their properties. Green building life cycle responsibilities are start from analysis, design, construction, materials, operation, environmental responsibilities, structure, renovation, maintenance and demolition. Most residential buildings are high rise apartment blocks built close to each other, resulting in severe sky obstructions. Indoor

environment and external sun light reflecting sources are taking major role for interior lighting. In this kind of critical structures, some of the areas only get direct sun light. From there we need to act like intermediate to spread the sun light source to entire residency through reflecting materials. In our research we are concentrating for green building as well as reusing plastic wastes. Plastic is a challenge for green world. So plastics waste needs to use a long time usages. This researches under takes the plastic usage, reusable plastics, maximum usage of plastic products and solution for reusing plastics through green building.

Objectives:

- ✓ Increasing the sunlight source utilization in high rise buildings without electricity.
- ✓ Reducing the concrete mix expenses as well by reusing plastic waste.
- ✓ Green buildings are designed to reduce the overall impact of the built environment on human health and the natural Reducing environmental impact.
- ✓ Generating the worldwide awareness about plastic recycling and usage of recycling waste plastics.
- ✓ To converting the waste plastics in the manner of recycling and reusable of building material will help to illuminate the lighting level.

Need For the Research:

1. To utilize the maximum Day lighting Energy for the residential building.
2. Reusing of plastic materials converted as cement plastic boards to the optimize day lighting, to construct the building as a green building.

3. PLASTIC WASTE AND MANAGEMENT

Plastic products production crosses 150 million tons per year globally. The recycled plastics are more dangerous to the environment. The only recycling of a virgin plastic material is able to be done 2-3 times. After each recycling, the strength of plastic material is reduced due to thermal degradation. Here it is to mention that no authentic estimation is available on total generation of plastic waste in the nation state however, considering 70% of total plastic consumption is leftover as waste. A Lot of plastic sources are living, since plastic's low cost, ease to manufacture, versatility and imperviousness to water, plastics are used within an enormous and expanding range of products, as of paper clips to

spaceships. Packaging and another third in buildings such as piping used in plumbing or vinyl siding. In India 42% of waste are coming from packaging of machine and materials, 20% of waste from protection, covering of spares and accessories of automobiles, 10% of wastage from furniture, toys and so on at last 28% of wastage from other minor packaging of oil, milk, carry bags, other chocolates and grosser items. Types of plastics and our concentration of selected plastic waste is tabulated below,

Table 1: Types of Plastics

Name of the Plastic Material	**Usage**
Polyethylene terephthalate	PET, PETE - Soft drink, water bottles
High density polyethylene (HDPE)	Water pipes
PVC (Polyvinyl chloride)	Non-packaging uses are electrical cable insulation
LDPE (Low density polyethylene)	Cling films, flexible container lids
PP (Polypropylene)	Reusable microwaveable ware
PS (Polystyrene)	Disposable cups, plates, trays and cutlery, Thermocol
ABS or Polycarbonate	Beverage bottles, baby milk bottles

PET bottle and Thermocol has been selected for creating plastic boards in this paper. Since in our routine life these two things are utilized to the greater extend. As a result, waste of quantity has been consequently increasing in the environment. There by we have selected PET bottle and Thermocol as reusing materials. According to the experts, polymer consumption by Indian plastic industry is likely said to be two times in next 6 years. It means that the magical figure of 20 Million metric tons can be expected by 2020. Therefore, now calculate how much of waste will be generated in our nation.

The PMC (Pune Municipal Corporation) is forecasting to set up a thermocol waste processing plant with the intention of recycling nearly 3.65 lakh kg thermocol waste generated in the city each year. Thermocol is used in huge quantities on behalf of industrial and packing purposes, as in eateries in the form of thermocol plates and also glasses. Indeed, each day,

nearly 1,000 kg thermocol waste is disposed of in garbage bins, rivers otherwise nullahs, which is leading to pollution. PET bottles usage was very high and in the mean time PET bottles wastage also very high. So for green building, PET bottles are taken for generating reflecting boards in this research paper. Some of the natural properties of PET:

1. PET in its natural state is a colorless and semi-crystalline resin.
2. PET can be semi-rigid to rigid, and it is very lightweight.
3. 60% crystallization is the upper limit for commercial products, with the exception of polyester fibers.
4. The intrinsic viscosity of the material, found by extrapolating to zero concentration of relative viscosity to concentration, which is measured in deciliters per gram (dℓ/g).

Table 2: Properties of selected products

PROPERTIES	PET BOTTLES	THERMOCOL
PHYSICAL	PET in its natural states is a colorless, semi-crystalline resin.	It is a synthetic aromatic polymer made from the monomer styrene. Polystyrene can be solid or foamed.
	PET can be semi-rigid to rigid and it is very light weight.	Polystyrene is a non-Newtonian fluid with viscoelastic properties.
	60% crystallization is the upper limit for commercial products, with the exception of polyester fibers.	Tensile and flexural properties are also important representation of the strength of polystyrenes.
CHEMICAL	Molar mass: variable	
	Density:1.38 g/cm^3 (20•C), Amorphous: 1.370 g/cm^3,Single crystal:	Density: 0.96 – 1.04 g/cm^3

	1455 g/cm^3	
	Melting point: > 250•C, 260•C	Melting point: ~240•C (464•C; 513 K) (decomposes at lower temperature)
	Boiling point: > 350•C (decomposes)	Thermal conductivity: 0.033 W/(m.K) (foam,p 0.05 g/cm^3)

Figure 1: PET Bottle

Figure 2: Products of Thermocol

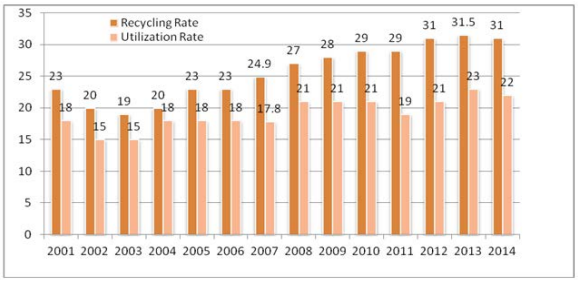

Figure 3: PET Recycling and PET material utilization rates

3. LEED – METHOD FOR THE GREEN BUILDING STANDARD

The United States Green Building Council (USGBC), is a national non-profit entity, developed by the Leadership in Energy and Environmental Design (LEED) Green Building Rating System in order to rate new and existing commercial, institutional and high-rise residential buildings in accordance to their environmental attributes along with sustainable features. It utilizes a list of 34 potential performance based credits worth up to 69 points and 7 prerequisite criteria, split into six categories:

- **Sustainable Sites**
- **Water Efficiency**
- **Energy and Atmosphere**
- **Materials and Resources**
- **Indoor Environmental**

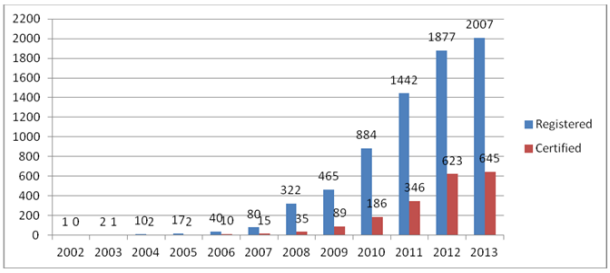

Figure 4: Growth of Green Building in India since 2002

In this paper we are focusing materials and resources then innovation design for utilizing the sun light source through plastic board with reflection coating for reflection. However reflection angles and re-reflection angles should be planned before fixing boards itself based on construction. The Materials and Resources credits (MR credit), these are the most relevant to product manufacturers. Those credits include:

MR Credit 1:	Building Life Cycle Impact Reduction	
MR Credit 2:	Building Product Disclosure and Optimization	Environmental Product Declarations
MR Credit 3:	Building Product Disclosure and Optimization	Sourcing of Raw Materials
MR Credit 4:	Building Product Disclosure and Optimization	Material Ingredients

4. MATERIAL RECYCLING AND RESUABLE (LEED)

In this research the plastic material using Hatscheck Method for preparing plastic board. Following steps to process of Standard Cement Plastic Boards:

Sheet formations on the Hatschek Machines occur in 4 stages:

1. Initial formation of a filter layer on the surface of the sieve.
2. Building of an extremely watery layer of fiber cement more than the filter layer while the sieve rotates in contact through the slurry within the vat.
3. Low intensity dewatering of the wet film as it transfers to the felt.
4. High intensity dewatering of the film as it surpasses in the course of the nip of the accumulator roller.

The basic part of the Hatschek machines consist of a vat in which a cylindrical sieve rotates within contact through dilute water

based slurry of fibers able to form a filtering film along with mineral materials comprising Portland cement.

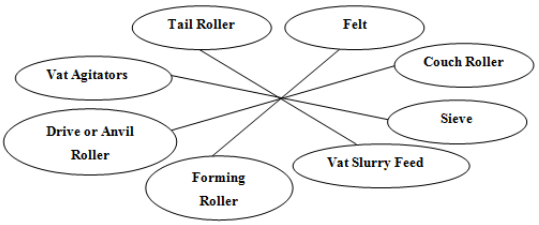

Figure 5: Components of Hatscheck process

5.METHODOLOGY OF CEMENT PLASTIC BOARD MANUFACTURING

Cement Plastic Board, a variant of wall panelling, is a cement bonded particle board made out of 62% cement & 28% waste product of PET plastic and Thermocol. The PET waste plastic collected from the garbage around the city limit in enormously and it converted for the particles sizes ranged from 1mm to 4mm and the thermocol is the waste product from Polystyrene (Disposable cups, plates) also collected and added into the particular percentage to the particle board. Due to adoption of a special manufacturing process, the panel acquires the strength and durability of cement & the easy workability of PET plastic and Thermocol - combination of qualities absent in other boards. Cement is strong & durable and is not affected by fire, weather, termites, etc. PET plastic and Thermocol is light and durable, & is easily machinable. As the particles in the board are compressed with necessary heating during the manufacturing process, the particles become thinner & more bonded with cement which results increasing in stiffness. The waste plastics are also termite and vermin resistant.

Cement Plastic Boards has contained no hazardous material like Asbestos or Formaldehyde. Its process is harmless. These boards comprise diverse applications ranging commencing partitions headed for false ceilings, wall claddings and building facades. The boards are available within a range of self-embossed designs. Keeping aesthetics and along with practicality in mind, Cement Plastic Boards has been designed to complement and improve the ambience of the structures they grace, be it an office or a home.

The boards were made up of fire, water, weather, termite, & vermin resistant and achieve both dimensional & chemical stability over a long construction period. Cement Plastic Board to **I.S.O. 8335 / 1987 (International Standards Organization) & I.S. 14276 / 1995.** Further, Cement Plastic Boards can be used for the construction of fire resistant building elements to satisfy the criteria of I.S.O. 834-1975 & I.S. 3809 - 1979 for 1/2

hour to 4 hours fire rating. Bison is eco friendly with IGBC certificate & GRIHA / SVAGRIHA compliance.

1. **Specifications:**
   - Name: Cement Plastic Board
   - Type: Wall Panelling Boards
   - Composition: 62% Cement, 28% waste product of PET plastic & Thermocol, 10% Water & Chemicals
   - Colour: Light Grey With Design (Can be painted)
   - Thickness: 10 mm
   - Standard Sizes: 4 feet x 2feet
   - Density: 1139 Kgs / Cubic Meters
   - Fire Resistant: Class 'O' Building Tested in accordance with **BS 476**
   - BIS Certified: Confirms to **IS 14276 - 1995**
   - Eco-friendly: IGBC Certificate & GRIHA / SVAGRIHA Compliance
   - Hazardous Material Composition: No hazardous material like Asbestos or Formaldehyde

Figure 6: Cement Plastic Board

2. **Raw Materials:**
   1. OPC (Ordinary Portland Cement)
   2. Waste PET Bottle fibres sizes ranges from 1mm to 4mm
   3. Thermocol fibres sizes ranges from 1mm to 4mm
   4. Super Plasticizer (Conplast SP 430)
   5. Lime powder
3. **Method for preparation of plastic board**

1. Initial formation of a dry mortar blended with cement & lime powder.
2. Cement in 75% and lime mortar on 10% ratio has mixed within a dry condition.
3. The fibre material added on the percentage of 4% on each to the dry mortar, mixed with mechanised rotating arm.
4. The super plasticizer of SP 430 in Fosrac as mixed with the dry

mortar on the 4% of volume of cement.

5. The water also mixed with the mortar on the percentage of 2% with the volume of cement.
6. The mortar slurry spreading over a mould of sides is ribbed with offset beeding for a better connectivity in each board.
7. The moulds get vibrated up to 2 to 3 minutes.
8. The top has neatly finished and making netted finish for better bonding connectivity.
9. The thickness of boards has 6mm to 16mm in varies depending on the usages.
10. The boards kept for curing and finally conduct the necessary tests are as detailed.

Figure 7: Cement waste plastic board

4. Analysis of Quality parameters:

1. Fire resistant
2. Weather resistant
3. Density - 1250 Kgs / m3 (1100 Kgs minimum as per BIS)
4. Moisture content - 9% + 3% at Factory Point.
5. Modules of Elasticity (bending) - 3000 N/mm2
6. Bending strength 9N/mm2
7. Transverse tensile strength (perpendicular to surface) 0.4 N/mm2
8. Compressive strength (perpendicular to surface) 15 N/mm2
9. Surface Alkalinity pH between 11 and 13
10. Nail holding power perpendicular to surface. 205 Kgs
11. Screw holding power perpendicular to surface 312 Kgs

5. Installation of Boards on the walls surfaces:

- By using of natural Gypsum powder is the main binding material of the boards with the wall at the time of installation.
- Keep that boards on the necessary thickness has to be maintained to the wall surfaces on line with taking of proper supports for keeping the verticality.

- The size of boards has to be taken for 1.2m x 0.6m x 10mm thick.
- In 600mm position has to be taken in vertical on the line 1.2m should be keeping in horizontal with matching of the room sizes in necessary cutting on the boards.
- The gap between board and brick wall area filled with Gypsum slurry for a better bonding.
- The Gypsum has been a better workability for taking the further line over the surfaces.
- After completion of the wall cladding up to, the roof surfaces the joint between each board has filled with putty finish.
- A good reflector of VOC paint has applied over the board surfaces will make the better reflecting and increasing the illumination.

Figure 8: Installation of board in wall or reflecting area

6. High illuminance of low VOC emulsion paints over boards:

- (**VOCs**) are organic chemicals that have a high vapor pressure at ordinary room temperature.
- There high vapor pressure results from a low boiling point.
- Low VOC paints improve indoor air quality and reduce urban smog.
- The beneficial characteristics of such paints include low odor, clean air, and safer technology, as well as excellent durability and a washable finish.
- **Low:** VOC paint types include latex (water-based), recycled latex (water-based), acrylic and milk paint.
- The labels of paint cans can be checked for the following information:
- **To be considered low:** VOC, the paint should contain <50 g/l of VOC.
- **To be considered zero:** VOC, the paint should contain <5 g/l of VOC.

- Solid content usually ranges from 25-45%, higher solid percentages indicate less VOCs.

Parameters	Conventional Paints	Low/Zero VOC Paints
VOC content before tinting (gram per liter)	250-800	50 for Low VOC 5 for Zero VOC
Color ranges	All colors	Lighter colors
Texture	Flat or Glossy	Flat only
Base	Oil or Latex	Latex (Oil in rare cases)
Odor	Suffocating	Less or None
Cost per gallon	INR 720-3,000	INR 1,800-4,200
Performance over 20 years	4-5 coats needed	1 coat is enough

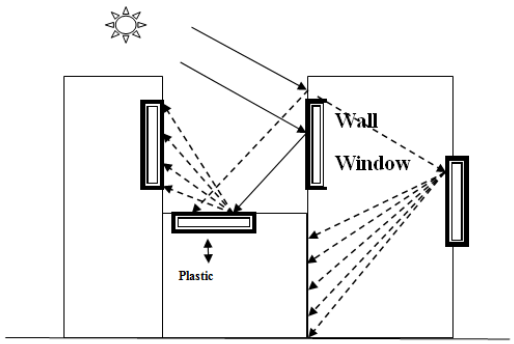

Figure 9: Model innovation design layout with plastic board

7. Merits of Cement waste plastic boards:

- No shrinkage cracks developments
- No seasonal variations
- Easy to handling
- No skilled labors required
- No water curing required
- Time savings
- Save of natural resources of river sand

8. The Advantages of Gypsum powder is:

1. Gypsum is directly applied on brick, block or RCC, hence no putty finishing required.
2. It requires no curing, however ready to paint.
3. Gypsum saves time and money
4. Gypsum expands slightly on setting and is not, consequently

possible to cause cracking of surface.

5. On during out it forms a sufficient dense to resist normal knocks.
6. Gypsum is comparatively easy to spread and level.
7. Consumption of paint can be reduced up to 30%.
8. Gypsum has no appreciable chemical action on paint.
9. Gypsum spread and finished to a minimum thickness increasing carpet area.
10. Gypsum is perfectly lined, levelled, sharp corner and smooth surface.
11. Saving on electricity meant for air conditioning as gypsum has extremely low thermal conductivity.
12. It is more durable and a green material.
13. Gypsum light in weight therefore reduces the load on structure.
14. More cleanliness on site because it is bag packed product and no curing is require.

9. Advantages of low VOC paints as recommended by IGBC

VOCs react by means of sunlight along with nitrogen oxides in the atmosphere to form ground level ozone, a chemical so as to have a detrimental effect on human health, agricultural crops, forest and also ecosystems. These problems are able to be eradicated by using low VOC paints.

6. CONCLUSION

Day lighting is one of the gifts of natural resource. India is located in both the eastern and northern hemispheres. Thus there are no dark days in all 365 days. Since the population and large buildings we are missing our natural sunlight source inside the building. Through green building concept, our research has been used by reflecting angles inside of the building forgetting the sun light source naturally with long life time products, which cost less products, reusing plastic and finally by thermocols. Through green building, this research has been supported for green world.

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