Planning and Design of a Green Commercial Building by using Software

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Abstract – In today's world, where materials used in building construction are few, adopting greener and more environmentally friendly methods and materials has become a need. This study article examines the impact of adopting such technologies and materials over their traditional counterparts in order to reduce non-renewable resource abuse and the harmful impacts on our ecosystem. Several materials and procedures have been brought to light that have proven to be a viable alternative to the traditionally or commonly used methods and materials in the field of building construction. The implementation of these materials and methods will undoubtedly revolutionise the sector of building construction. These techniques have the ability to replace these conventional materials and also pave way for a greener way of building construction that will contribute towards rebuilding the planet's environmental health and put a stop to several destructive and hazardous calamities like the greenhouse effect and so on. We have replaced the conventional red bricks with compressed earth bricks and used sustainable concrete in place of conventional concrete. Non-conventional and renewable energy sources have been brought into application to achieve energy efficiency and optimize the energy performance in the building. A water harvesting system has also been installed for collection and storage of rainwater which can be used in future for various purposes or can be used for the refilling of ground water table which gets depleted due to the daily use of water for various requirements .

1. Introduction - Structures have an exceptional impact on the piece of ground because the accoutrements employed in their construction are deduced from natural coffers. They are chargeable for the migration of conservatory feasts through the producing of merchandise and additionally cause pollution in their exploitation and transportation. From the piece of ground perspective read the structure sector has the maturity of adverse impact on the earth's system. So as to place Associate in nursing finish to any or all these issues we'd like to manoeuvre towards a greener approach of erection construction.

A'green 'structure may be a structure that, in its style, construction or operation, reduces or eliminates negative impacts, and may manufacture positive impacts, on our climate and natural piece of ground. Inexperienced structures save precious natural coffers and ameliorate our quality of life.

There are variety of options which may create a structure 'green'. These embody

- Effective use of energy, water and different coffers
- Use of renewable energy, similar as solar power
- . Pollution and waste reduction measures, and therefore the sanctionative of play and utilisation
- . Smart inner environmental air quality
- Use of accoutrements that are non-toxic, moral and property
- . Thought of the piece of ground in style, construction and operation
- . Thought of the standard of lifetime of inhabitants in style, construction and operation
- . A style that permits adaption to an ever-changing piece of ground

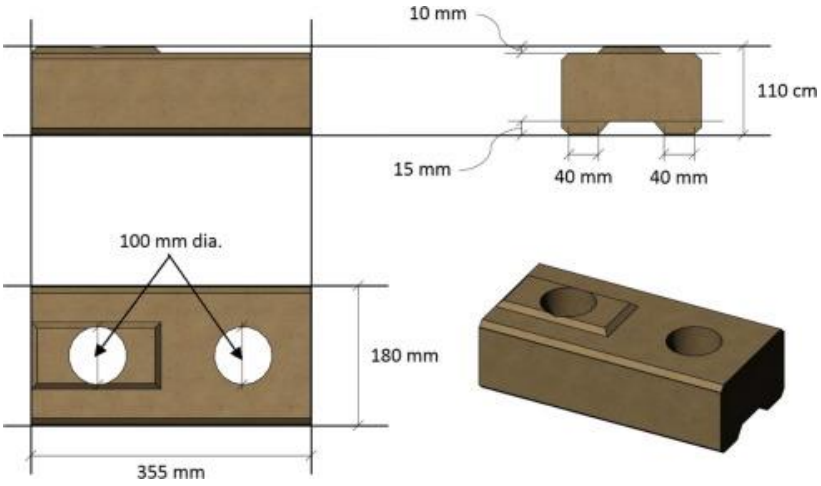
Green buildings can be an effective and eco-friendly alternative to the conventional building methods that are a hazard to the plant's environmental health. These buildings can very ell bring change in the field of construction and lead us to a greener and healthier future where there won't be scarcity of any resource and the people will be able to live comfortably and stay in a healthier and eco-friendlier environment. These buildings are the trends that may take over the construction field in the new future as the whole world is taking a step towards finding sustainable options of development and contribute towards the betterment of the nature.

1.1. Compressed earth blocks

A compressed earth block (CEB), also known as a pressed earth block or a compressed soil block, is a building material made primarily from damp soil compressed at high pressure to form blocks. Compressed earth blocks use a mechanical press to form blocks out of an appropriate mix of fairly dry inorganic subsoil, non-expansive clay and aggregate.

These block are economical in expenses and are easy to make as they can be prepared on the construction site itself.

CEBs are more comfortable, cooler in the summer and warmer in the winter. They use less energy to modify the temperature when it needs to be modified. They're extremely adaptable to nice, complex designs. They're load bearing, so you can do whatever you want with the walls, with some limitations.



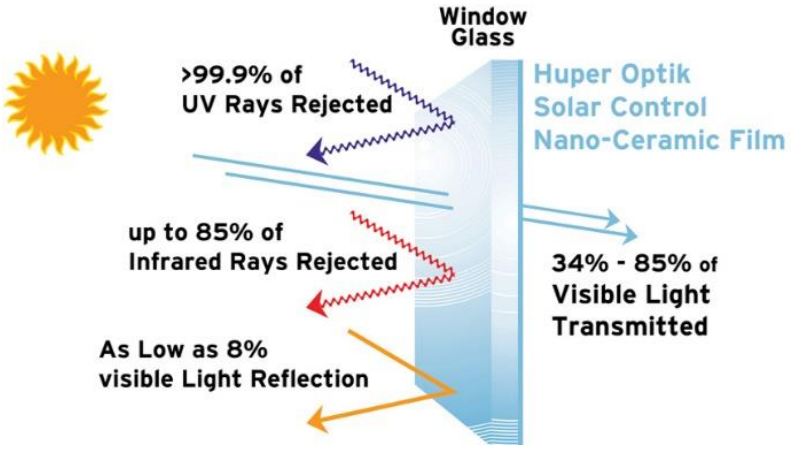
1.2. Low VOC paint

VOC or Volatile Organic Compound is a drying agent used in paints which keeps evaporating from the walls over the due course of time. It is also hazardous to the human health. Low VOC paints are an eco-friendly alternative that can be used in the buildings as they are non-hazardous to human health and also spread easily as compared to the ones with higher VOC.

1.3. Reflective Glass Unit

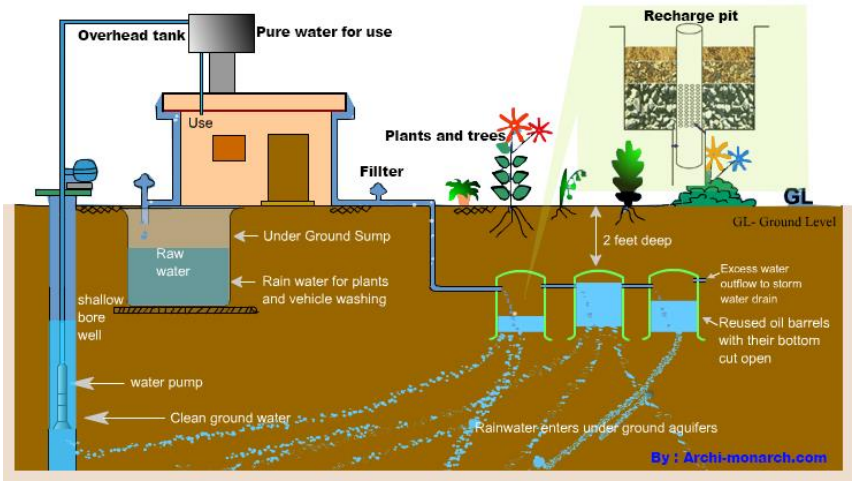
Reflective glass is annealed or standard glass that has a thin caste of metallic or metallic oxide coating. Since this coating is applied to only one side of the glass, it has a glass-alike appearance.

This reflective coating is applied during the pier process to enhance the amount of heat reflected by the glass. It can absorb and reflect the sun's dangerous UV and infrared shafts yet allow natural visible light to pass through. It also prevents devilish solar light. Still, it does allow natural light to pass through, offering optimal day lighting.



1.4. Rainwater harvesting

Rainwater harvesting systems helps in achieving water effectiveness that's needed in a green structure as it collects and stores water which can be kept for future or exigency use and is also useful in refilling the ground water table that gets depleted due to the diurnal consumption of water for colourful purposes.



1.5. Building Integrated Photovoltaic

Photovoltaic (PV) panels are an amazing way of generating energy and also for achieving energy effectiveness as they're fully eco-friendly. These panels can convert the solar energy into electrical energy and optimise the energy performance in the structure. They prove to be relatively fruitful in the long run.

2. Design and Plan

The designing and planning of the structure has been performed on **AutoCAD** and its analysis has been performed on **STAAD Pro**

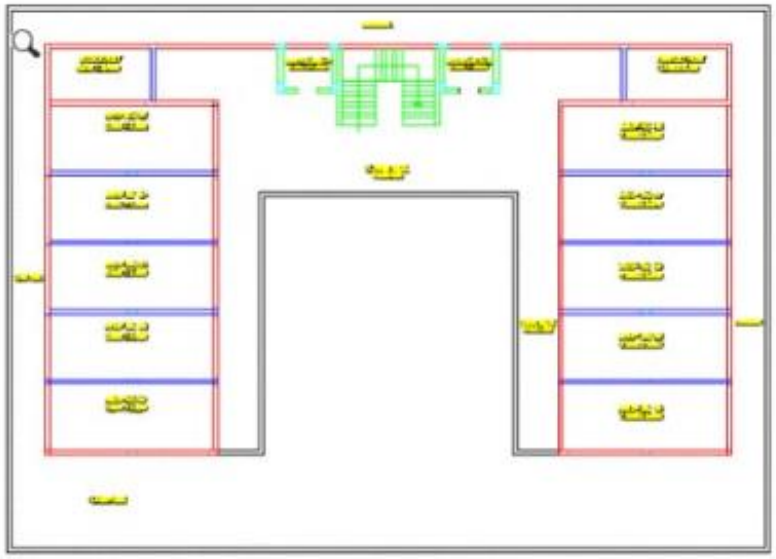


Fig. 2D plan of the building

Fig. 3D Model of the structure

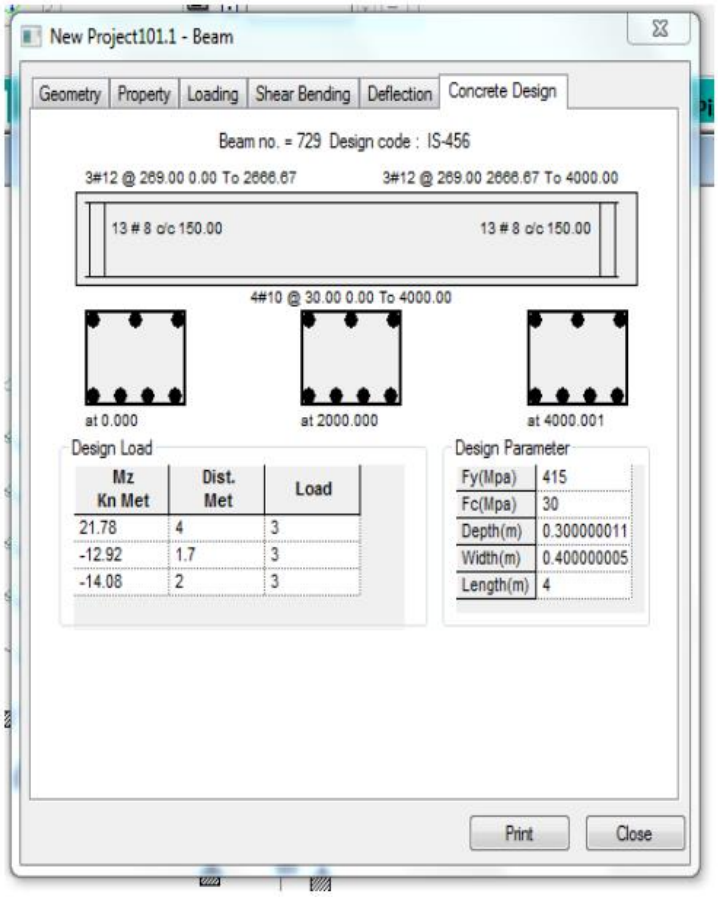


Fig. – Beam Design

Node Displacements Cont...

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
	3:Z1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4:Z1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5:DL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6:LL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
262	1:X1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2:X1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3:Z1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4:Z1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5:DL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6:LL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
263	1:X1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2:X1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3:Z1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4:Z1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5:DL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6:LL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
264	1:X1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2:X1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3:Z1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4:Z1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5:DL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6:LL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
265	1:X1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2:X1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3:Z1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4:Z1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5:DL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6:LL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
266	1:X1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2:X1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3:Z1 +VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4:Z1 -VE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5:DL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6:LL	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fig. - Node displacements

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	X1 +VE
Primary	2	X1 -VE
Primary	3	Z1 +VE
Primary	4	Z1 -VE
Primary	5	DL
Primary	6	LL

Fig. – Load Cases

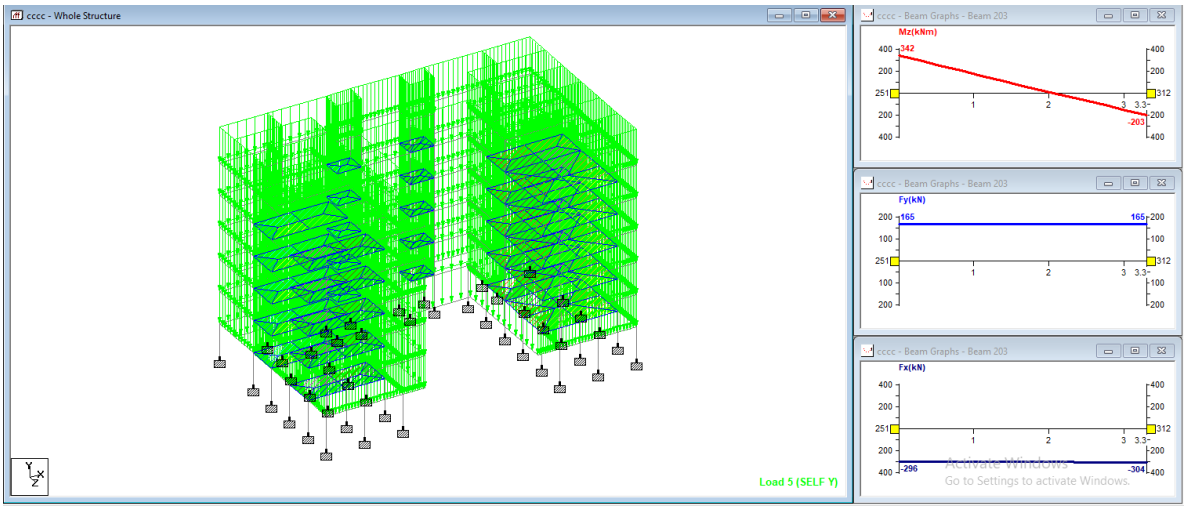


Fig. – Load on beams

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	Rect 0.40x0.30	1.2E+3	90E+3	160E+3	194E+3	CONCRETE
2	Rect 0.45x0.23	1.04E+3	45.6E+3	175E+3	124E+3	CONCRETE

Materials

Mat	Name	E (kN/mm^2)	ν	Density (kg/m^3)	α (/°C)
1	STEEL	205.000	0.300	7.83E+3	12E -6
2	STAINLESSSTEEL	197.930	0.300	7.83E+3	18E -6
3	ALUMINUM	68.948	0.330	2.71E+3	23E -6
4	CONCRETE	21.718	0.170	2.4E+3	10E -6

Fig. – Section Properties and Materials

3. Future Scope

Green buildings are truly well on course of replacing their conventional counter-parts as they are superior in every aspect that is considered in the construction of structure and on top of everything they are also responsible for contributing towards the environmental health of the earth as well as they also prove to financially salutary as compared to normal structures.

These structures have the eventuality to come the future of construction field as they prove to be fruitful in resource conservation. These structures retain the capability to pay huge tips in the future as they're bound to stay for a longer period of time and give an advanced rate of effectiveness in case of water, energy and material as compared to the conventional structures.

4. Conclusions

The aim of our design was to replace some of the rudiments used in a conventional structure with the bones that would give the necessary green element in the structure that would be considered feasible for marketable use and also fulfil the three above mentioned edge

To achieve material effectiveness we used accoutrements similar as low VOC makeup, compressed earth block, sustainable concrete, etc.

For achieving energy effectiveness reflective glass units, solar panels were installed in the structure.

For water effectiveness, a rainwater harvesting system was installed in the structure that would help in collection and storehouse of rainwater which would come in use in the future or might as well be used for replenishing the underground water table.

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