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Sustainable Construction for a Greener Tomorrow: A Comprehensive Exploration of Environmental Impact and Educational Interventions

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ABSTRACT: The construction sector has a lot of potential to reduce environmental harm's consequences while advancing sustainability's social and economic facts. This research aims to find how Sustainable construction affects the environment in an exemplary manner and how we can convert and construct a sustainable building. Energy, water and sewage, materials, health and interior environment, eco-cycle, the location, to some extent symbolic meanings, traffic, and economics, as well as the design/construction process and user participation, are the aspects that are explored more closely. Sustainability is a multi-dimensional topic around the world's social, economic, and environmental factors. Sustainable construction generally refers to implementing sustainable development concepts in the building sector. Its priorities, definitions, and interpretations will primarily rely on the field of research. Despite the many benefits that sustainable construction is said to have, it still needs to be a widespread practice in the building sector. For a sustainable future, we must do a lot of work to retrain the brains of those working in industries with weak economies. This study examines the effectiveness of using psychological variables and educational interventions to bring about such change. The research advances its contribution to the area by developing an educational intervention that promotes alternative pedagogies for sustainability education.

KEYWORDS: Sustainable Construction, sustainable design, environment, building, social, economic.

I. INTRODUCTION

The construction sector is responsible for building a large portion of the world's manufactured capital and the physical assets that serve as the foundation for almost every development element. As a result, this sector significantly impacts our society, economy, and environment. Economically, the built environment typically accounts for more than half of total national capital investment in practically every nation globally (CIB 2002). Socially, the construction industry accounts for about 7% of all employees globally, making it the foremost industrial employer in most countries [1]. Construction activities are labor-intensive, which offers the potential to reduce poverty. The building sector is one of the worst polluters of the environment and has a significant impact on both the living and working environments [2]. The sustainability of the construction sector is crucial since it has such a significant impact on our economy, society, and environment.

The Brundtland Report, was released in 1987 by the World Commission on Environment and Development (WCED). This study defines "sustainable development" as an expansion that meets present needs without endangering the capacity of future generations to do the same (WCED 1987). Present needs like saving the environment, constructing an efficient building. The sustainability idea requires striking a balance between the economy, society, and the environment. Construction companies are getting more attention from academics as the industry's representatives. By evaluating prior research on sustainability and construction businesses, this research seeks to contribute to previous studies and give a take on how construction can be done in the most efficient manner.

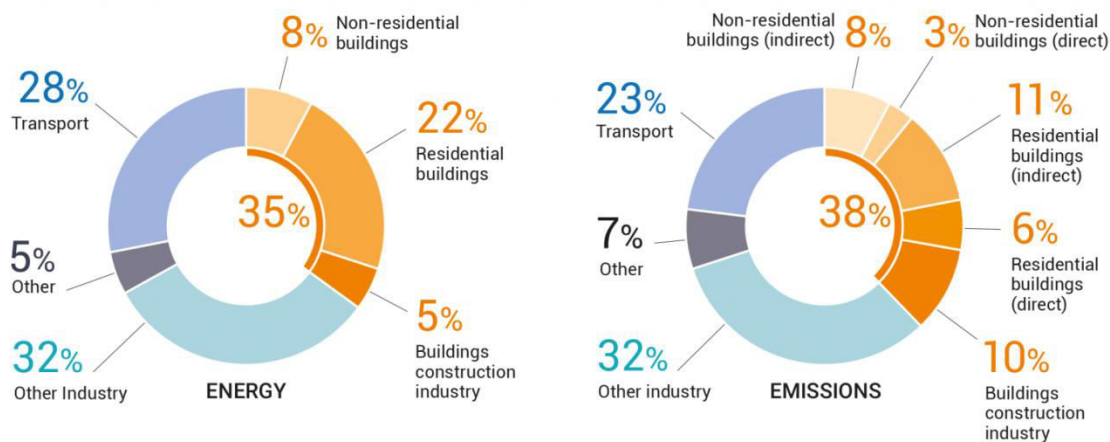


Figure 01: Building and construction share for energy and energy consumption in carbon emission

II. LITERATURE REVIEW

The building industry significantly negatively influences the environment in terms of emissions and energy use. In addition to the harm that the development of green field areas causes to natural ecosystems, energy is needed on the job site throughout the construction phase. Fossil fuels continue to be significantly utilized by heavy construction equipment. The building industry is also in charge of the energy required for finished buildings and the energy contained in construction materials [3].

Informed decisions impact the environment at every stage of a new construction project. The world's energy use and 40% of CO₂ emissions are surprisingly attributed to the construction industry. Materials manufacturing and delivery have a significant influence on carbon emissions. Water streams may get contaminated as a result of mining for raw materials. Currently, cement production results in 2.8 billion tonnes of CO₂ emissions annually. But if urbanization rates keep going at their current pace, these emissions may top 4 billion tonnes annually [4].

Naturally, utilizing sustainable construction methods will reduce the company's environmental effects. If the buyer of a new structure, requirements will significantly impact the project's specifications and the facility's long-term operating expenses. The project's high design and sustainability level may benefit the project's reputation and corporate social responsibility in the long run. Contractors in the construction sector may need to understand new materials and construction techniques to participate in the most lucrative and cutting-edge projects.

Realistically, operating costs for green buildings are cheaper. Research suggests that implementing the most advanced sustainable technologies in the construction sector could save the global economy €410 billion in energy expenditures per year [5].

Additionally, a business can instantly save money. For instance, it can save money on waste disposal fees by reducing garbage. Switching to more fuel-efficient automobiles can help save money on petrol.

Even while the sustainable building has gained more popularity recently, many people still need to learn about its full potential. Building sustainably is a modern approach that improves people's lives and how buildings are made, rather than just producing structures that have little adverse influence on the environment.

III. RESEARCH METHODOLOGY

Generally, when it comes to design a particular structure there are quite a few things we need to consider excluding all the necessary permissions we need to take. But for a student accommodation or I should say a private student accommodation which is need to be built sustainably we need to keep several more things in our mind. As In Delhi its extremely hot in summers and chilly in winters. As it has to be planned that ways like the heating and cooling system are not being compromised. Most of students do travel with their own transport in India so the parking should also consider as one of the priorities [7].

Along with all these points which are quite basic and should be implemented in any student accommodation all around the world. In India there might not be any problem regarding permissions and stuff where as in Edinburgh there are some legal and building regulations need to be considered before constructing such property [6].

1. HMO Regulations: - Every development that meets the HMO standards criteria is subject to the rules and specifications set forth by the local authority whose purview the product falls.

2. All pertinent provisions of the current Building Regulations and any applicable Approved Codes of Practice must be complied with by designs.

All walls and floors must adhere to the latest Building Regulations' specifications. The Local Authority Building Control or Approved Inspector should be consulted when determining the performance levels for walls (party and bedroom) and flooring.

Table 01: Sound insulation

	Airborne Sound insulation DnT, w + Ctr dB (Minimum values)	Impact Sound Insulation L' nT,w dB (Maximum values)
Walls	45	n/a
Floors & Stairs	45	62

To make my design sustainable I have improvised few things in my constructional design which are explained according to the parameters below:

1. Constructional design and material: - As per the climatic conditions and the surroundings of both the regions (Delhi). firstly, the design will be almost the same when it comes to the structure and the façade. Secondly the material used will be which is locally available like in Delhi, bricks for the masonry is locally available.
2. Façade: - majorly the Façade is used for the show and the outside presentation of the building and in our structure, it is also a element which is recycled and renewable. Any structure can have a façade of Glass and masonry.

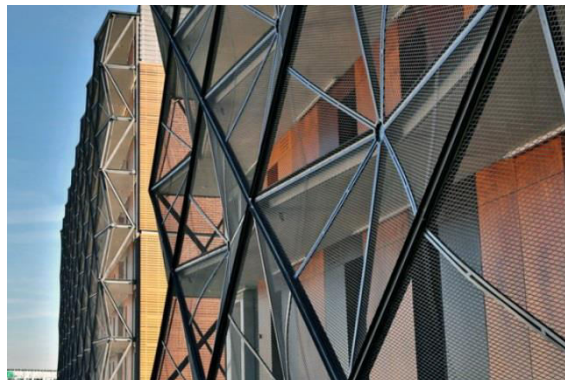


Figure 02: Glass Façade

3. Interior construction: - for a structure like this as in a student accommodation inner construction is something we look out for because it makes student live in their certain way. So, for the interior walls and partition we will be using timber walls and stones/tiles where necessary which are acoustic.



Figure 03: Acoustic Walls

4. Heating: - For the gas and heating we can use Bio mass boilers because instead of using geysers in every room bio mass boilers will be a better option and it is eco-friendly.

5. Cooling: - It will be an issue in summers in Delhi region because it gets extremely hot in summers and due to that we can use air conditions (ACs) but to go full eco-friendly we will be using ground heat exchange technique which is not so common but effective in summers as well as in winters. Using Ground as a medium to lower the air temperature and use it to keep the place cool.

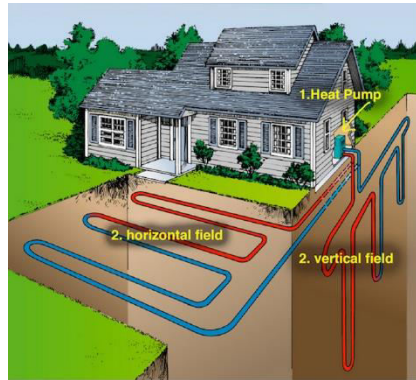


Figure 04: Alternative Heating and cooling method

6. Electricity: - to generate electricity we can use solar panels as our student accommodation doesn't have many rooms so solar panels is the best way to generate electricity sustainably.

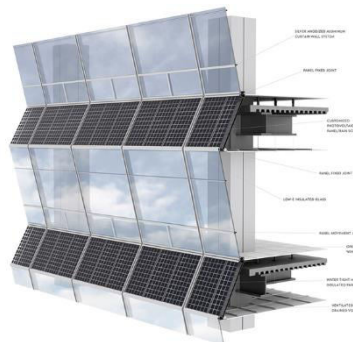


Figure 05: Solar panels as a façade

7. Water: - Usage of water for domestic use is something we cannot compromise with so along with the standard water supply we can have few basic yet important measure to save water like rain water harvesting tank or well at the top of the building and reduce the wastage of water, use of aerators taps instead of basic ones.
8. Under floor heating: - under floor heating is not a necessary thing but it can be done in common areas of the building because we might need that for the cozy and proper heating of that place.

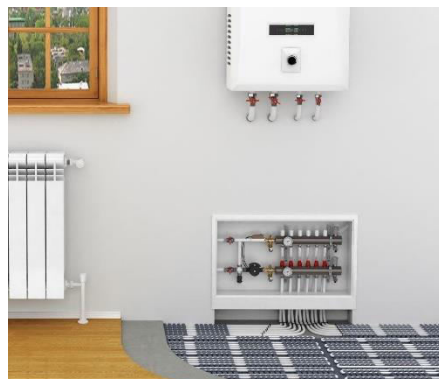


Figure 06: Underfloor heating

9. Rain water harvesting: - that is one of the important measures and yes having a rain water harvesting well or tank at the top of your building should become a necessary in for the structure.
10. Terrace garden: - it is not compulsory to have a garden in your building or outside of your building but to have a place where one can find peace or where one can sit and meditate and best for relaxation.



Figure 07: Terrace Garden

11. Interior design: - Interior of any building make a huge impact in giving it a winsome effect and attracting you towards it. And through eco-friendly material or green material we can achieve it and make it a better and smart place to live in.

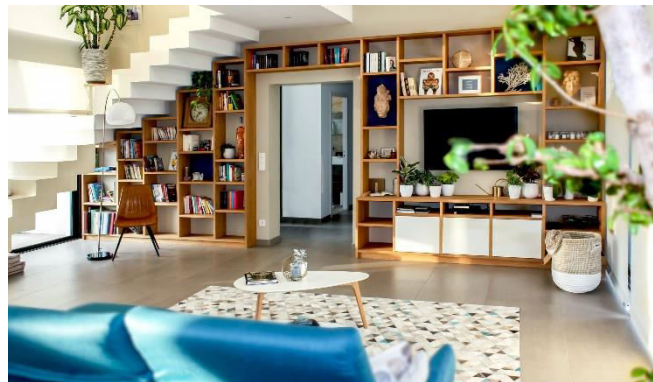


Figure 08: Eco-Friendly Interior

Designing a sustainable student accommodation can be tricky because we need to consider a few things to keep it balanced for every student living there. So, to keep it a trial or simple plan, a three-floor building for eight students to accommodate in their own space. To keep it sustainable, we have introduced timber walls, less use of concrete, biomass boilers, a terrace garden, recycled material waste, solar panels, rainwater harvesting tanks, a pleasant sustainable façade, and proper use of space [9].

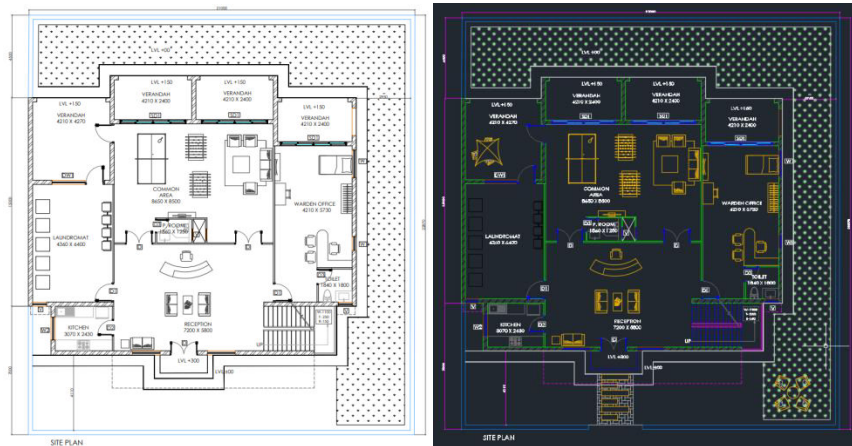


Figure 09: Site Plan



Figure 10: Front Elevation

IV. RESULT AND DISCUSSION

Analysing based on sustainability, we can build this particular design in Delhi. With the help of all the case studies and the research, we are convinced that constructing something this eco-friendly is possible and can be done in the better way possible. Sustainable construction is something that can enhance any building structure and can contribute to a better future.

Through this research, we can conclude the comparison between conventional and Sustainable construction. Concrete or brick walls are the most commonly used building material for standard construction in Delhi (India). The heavy use of Concrete blocks in construction makes it an un-efficient building; because of less awareness and zero experimentation in a region like Delhi, it is still a hypothetical project [11]. Carbon emission, waste of non-renewable resources, and having ordinary construction with less efficiency are something that should be eliminated from the construction sector. Acoustic Timber interior- walls and triple or double-gazing windows are combined with defined space, shared kitchen area, and green electricity is installed to attain proper efficiency. A terrace garden shows how efficient this construction is. Compared with Conventional construction techniques, rainwater harvesting tanks at the top or biomass boilers for such properties, terrace gardens, Laundromats, or with these spacious rooms and balconies, there are many things to make it more efficient. Having biomass boilers or ground-to-earth heat exchange pumps in place of standard geysers or radiators is one of the most eco-friendly things in this construction [8]. Electricity generation using solar cells will create an enormous impact. Triple glazing of windows will help to trap heat to maintain the warmth. As there is much rain, we have installed a rainwater harvesting tank at the top to use it and put more steps towards green and eco building.

The terrace garden gives the students that aura of creativity and peace during the day or at night. Ideally, the requirement for a standard bedroom size for student accommodation is 10-15 sqm. Still, we are providing 25 sqm, which is almost double and makes it a spacious and better place to live, along with the much more oversized

cabinet/closet. A student must have a study desk and bookshelf in the room for a creative and intellectual environment in which they can have their own productive time. A shared kitchen will help students diversify and help each other with things. For most the student, accommodation, whether private or anything, laundry becomes a specific problem; if we provide washing machines in every room, it will increase the space, or if we offer it in the kitchen, it changes the whole idea of eating together or so hence we have provided laundromat where few of the washing machines would be kept with proper drainage and piping which will help in cleaning and doing laundry efficiently. A common area or lounge does not mean just a tv space or something around it. Our shared lounge has a TV, a foosball table, and other indoor games. Verandah at the back has a natural soil flooring which is grass and soil with permeable pavement at the corners for that sustainable backyard. Our entire Site has been designed in such a way that each and everything can be ticked marks while checking the design guidelines. Moreover, for that purpose, we have a side L-shaped lawn for the students to keep a healthy and blooming environment.

Standard construction only gives some of these perks efficiently, making it a proper and complete construction. After having the cost comparison and all other parameters we all can conclude that sustainable construction is much better way of construction or the most efficient construction technique in this evolving world. Eco-friendly construction does not apply to design factors or construction materials, but one significant factor is how to execute the plan. Having a Plan like this on paper is one thing and performing it on Site is one. It is possible, but convincing everyone and making it happen is difficult for a long-term thing. It can surely change lives and give a better future. Sustainable construction can only get that practical and first priority in the construction sector because of engineers' execution issues. Still, to keep these things and to support every human being's future as a priority, we have to adopt these things. Sustainable construction is the future, and we need to have more efficient and green buildings to build a greener and healthy environment. Green construction is essential and better than conventional construction in every manner. These parameters and the design above prove that basic student accommodation needs to be built in every world city.

V. CONCLUSION

Sustainable is a word that has significantly impacted today's world. With the depletion of resources and the sudden environmental change, people have started thinking about sustainability. The construction industry is one of the biggest industries, and we can assume that adopting sustainable construction can eliminate most of the risks and hazardous effects on the environment. The best part is that we can do something manageable to achieve that. We need to improvise our building or construction techniques and methods and aim to reduce the industry's impact on the environment by using renewable resources and recycled material by reducing embodied energy and on-site waste. Through simple principles of sustainable construction, we can contribute to the world's safety and build effectively and efficiently. To prove that standard structure is not efficient or that sustainable construction can be perfectly normalizing. For the shorter construction or small property where sustainable building can be expensive or so can have sustainable gardens or landscaping. *The research* revolves around the construction of sustainable student accommodation to prove that it is a more accessible and better way of construction. To make it more understandable, designed buildings in areas like Delhi with entirely different environments and materials. We are using AUTOCAD, student accommodation, the project aimed to have the appropriate amount of sustainable material and make it the most efficient building. From the size of the bedrooms to the conventional way of heating is improvised and in a better way, a lot of help and information from the case studies and different sustainable construction is incorporated in this research paper, which keeps it a step ahead. Keeping all the design guidelines to the priority and construction of the building into its marks is what is kept in mind; as a result, elaborated sustainable structures help in better and more efficient construction. Apart from the initial cost of the project the entire project has an upper hand from the traditional construction.

Along with that, we contribute to a healthy and better future ahead. The primary reason to research a topic like sustainable construction was to study why we are still thinking and planning to adopt this particular construction method and not implement it in day-to-day construction. Designing a sustainable student accommodation was to prove that a structure that needs to be built in each city, state, and country and one of the most basic constructions can be built efficiently and sustainably. Sustainable construction should not be tomorrow's construction or the future of construction; instead, it should be today's construction for every structure. To build a better future for everyone, we need to save the environment, and to keep it, we need to adopt sustainable construction.

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