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A Feasible Study of Environment Vs Construction

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Abstract
Construction is a process that consists of building or assembling of infrastructure. Construction aims at making long live structures and buildings. But while buildings and development provide countless benefits to society, they also have significant environmental and health impacts. This paper was focused on environmental impacts caused due to construction industry and prescribes some suitable solutions to endangered problems. According to buildings**,** Cement and concrete are key components of both commercial and residential construction. A major component of concrete is cement, which has its own environmental and social impacts. Thus on comparing the effects of buildings on environment, Concrete recycling is suggested along with environmental awareness and Green Concept. Also as interest in protecting the environment, Green construction is the practice of erecting buildings and using processes that are environmentally responsible and resource efficient.

I. Introduction

In general, there are three types of construction i.e. building construction, heavy & civil construction and industrial construction. Construction is also described as the utilization of cement, sand, aggregates, concrete, steel, plumbing, conduits, electrical fittings, HVAC systems, wood work, painting, finishes etc. to make a dedicated structure which is utilized for some specific purpose.

Construction is a long lasting investment. Since past many decades, mankind is manipulating the natural environment to better suit its needs for providing accommodation for people, building industries, businesses and commercial centers, development of infra-structure and related amenities (roads, highways, electricity networks, playing areas, gymnasiums etc).

Environment is something that surrounds us, air, water and land. Environment consists of
all resources that are available on this planet which are being used and harnessed or are Pristine. Construction consumes our finite and non-replaceable resources renewable and non-renewable. The irony of the fact is that around 50% of all non-renewable resources mankind consumes are used in construction, making it one of the least sustainable industries in the world.

Cement and concrete are key components of both commercial and residential construction. Concrete and other cementitious materials have both environmental advantages and disadvantages. The environmental impact of concrete is a complex mixture of not entirely negative effects. A major component of concrete is cement, which has its own environmental and social impacts.

Conversely, concrete construction also has many sustainable benefits. The cement industry is one of two primary producers of carbon dioxide, a major gas. Concrete is used to create hard surfaces which contribute to surface runoff, which can cause heavy soil erosion, water pollution and flooding. Concrete is a primary contributor to the urban heat island effect, but is less so than asphalt. Concrete dust released by building demolition and natural disasters can be a major source of dangerous air pollution.

The presence of some substances in concrete, including useful and unwanted additives, can cause health concerns due to toxicidity and radioactivity. Wet concrete is highly alkaline and must always be handled with proper protective equipment. Concrete recycling is increasing due to improved environmental awareness, governmental laws and economic benefits.

II. Environmental Impacts

Construction is mainly about making buildings for various uses like housing, industries, commercial centers, recreation, healthcare etc. Construction impacts last for decades and affect the lives of current and future generations. Buildings consume major global resources. Almost 50% of global energy is consumed in buildings, while 50% water, 60% materials for buildings, 80% land loss to agriculture, 60% timber products, 90% hardwoods are all directly linked with building construction. Indirectly 50% of coral reefs destruction and 25% of rain forest destruction are all attributed to buildings and construction.

2.1 Carbon Di Oxide Emission And Climatic Change

The cement industry is one of two primary industrial producers of carbon dioxide (CO_2), creating up to 5% of worldwide man-made emissions of this gas, of which 50% is from the chemical process and 40% from burning fuel. The carbon dioxide CO_2 produced for the manufacture of one tonne of structural concrete (using ~14% cement) is estimated at 410 kg/m^3 (~180 kg/tonne @ density of 2.3 g/cm^3) (reduced to 290 kg/m^3 with 30% fly ash replacement

of cement). The CO_2 emission from the concrete production is directly proportional to the cement content used in the concrete mix; 900 kg of CO_2 are emitted for the fabrication of every ton of cement.

2.2 Urban Heat

Both concrete and asphalt are the primary contributors to what is known as the urban heat island effect. Using light-colored concrete has proven effective in reflecting up to 50% more light than asphalt and reducing ambient temperature. A low albedo value, characteristic of black asphalt, absorbs a large percentage of solar heat and contributes to the warming of cities.

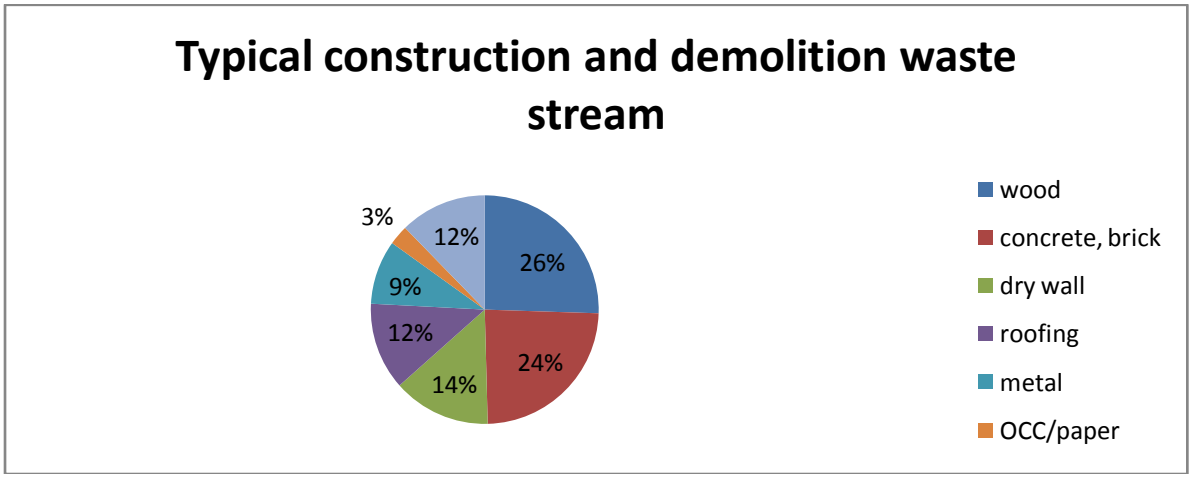
By paving with light colored concrete, in addition to replacing asphalt with light-colored concrete, communities can lower their average temperature.

2.3 Concrete Dust

Building demolition and natural disasters such as earthquakes often release a large amount of concrete dust into the local atmosphere. Concrete dust was concluded to be the major source of dangerous air. Some other environmental impacts of concrete are

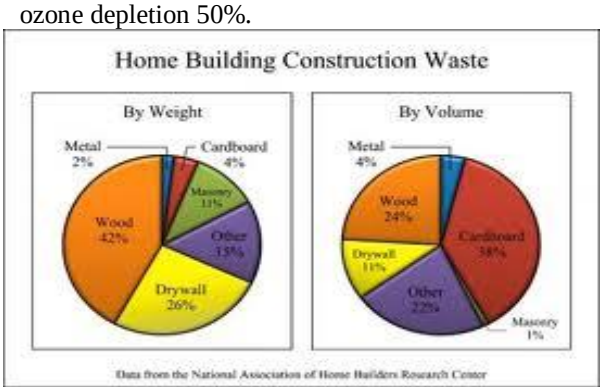
- Water pollution
- Nitrous oxide emissions
- Particulate air emissions
- Visual pollution
- Traffic congestion
- Noise pollution

Life Cycle Analysis is a tool developed in order to describe the environmental impact caused by a product in all the stages of its life, from the extraction of resources until the disposal of waste. This method allows comparative studies between products and processes having the same function.



III. Construction Impacts

Construction causes pollution. The construction business in many countries is responsible For nearly a third of all industry-related pollution incidents. There is no construction which does not have an environmental impact. The main aspect of construction is making buildings of varied uses be it for residential, commercial, industrial, recreation, healthcare or any other purposes. The estimate of global pollution that can be attributed to buildings is air pollution 23%, climate change gases 50%, drinking water pollution 40%, landfill waste 50% and ozone depletion 50%.



The major impacts of construction are excessive energy use, global warming and climate change. Energy is consumed when extracting raw materials, producing materials (manufacturing process), transporting materials, transporting workforce, building structures, using and powering structures, maintaining structures and demolishing. In addition, energy is also required for the operation of any structure(s). In construction, choice and selection of appropriate material play a major role. We need to adopt a sustainable approach in choosing and using materials.

The environmental and economic benefits of sustainability are inherently linked when considering building materials. This is due to the long-term financial advantages of recycling, using recycled products and sourcing heavy materials locally.

The other major impact is due to pollution generation and presence of hazardous substances in the natural and built environment. Pollution arising from the built environment includes sewage, waste etc., pollution caused during the manufacture of materials and products, pollution and hazards from the handling and use of materials and actual Construction and site related activities. Considerable

pressure can be placed on the local road network and neighboring uses by quarrying operations.

IV. Controlling Measures

4.1 Environmental Awareness

To minimise environmental impact it is important to understand the link between various construction activities and the potential for these activities to impact on the environment. The environment is defined as .living things, their physical, biological and social surroundings and the interactions between all of these.

Environmental management measures will depend on the nature of the site activities and the sensitivity of the project area and surrounding land. For example, excavations resulting in steep slopes are likely to lead to soil erosion and water quality problems downstream and will require the installation of erosion protection measures.

At the completion of this course participants will be able to:

- understand common environmental terms
- state their legal obligations and responsibilities in relation to environmental legislation
- recognise common environmental impacts on construction sites and potential impacts resulting from the individuals work activities
- identify accepted current environmental management best practices for relevant workplace activities
- identify situations which require further advice about appropriate work practices to minimise environmental damage.
- Everyone on site is responsible for complying with environmental legislation

4.2 EMIP

Environmental management relates to the control of human activity which could impact on the environment. Construction of transport infrastructure can have significant environmental impacts if not undertaken with care. An environmental management system has been to minimise the environmental impact of projects. The system is outlined in the flow chart as follows:

The construction site may also be licensed by the Environment Protection Agency (EPA). The licence may include specific conditions such as soil erosion controls, dust and noise monitoring. For contractors the most important elements of the system are the *Environmental Management Implementation Plan (EMIP)*, environmental inspection and monitoring.

The EMIP describes how the environmental management requirements, identified in the Environmental Management Plan (EMP), will be implemented and managed on site.

4.3 Guidelines for Implementing Successful Construction Waste Management Practices

S. No	Description	Standard practice	Better performance	High Performance
1.	Specification	Selecting the standard specifications to fit the project	Selecting the specification under green goals to reduce waste generation	Preinstallation conferences with contractors and subcontractors to have better communication
2.	Sitework	Existing vegetation scraped off for construction	Areas to be protected and fenced for vegetation	Existing vegetation should be protected during construction
3.	Construction process	Minimal attention to energy and water usage	Efforts must be taken to improve the energy-water intense process	Comprehensive effort to document energy usage the most energy- and water-intensive and water usage and avoid waste
4.	Construction Waste	Segregation and disposal	Recycling	plan implemented for material and waste reduction
5.	Construction IAQ	No special attention to indoor air quality effects in construction	Increased ventilation during pollution	Plan implemented for protecting IAQ during construction and prevention action

4.5 Steps to Reduce Environmental Impacts

In the live pavement project following are the steps are recommended to implement for reducing the environmental impacts:

1. Walk the construction route to identify the limit of vegetation clearance, significant vegetation, no go Areas, locations for stockpiles, plant compounds and access roads.
2. Clearly identify the extent of the construction area and those areas to remain undisturbed.
3. Ensure machinery and equipment are clean before bringing to site.
4. Keep work and vehicles within the construction area.
5. Keep machinery and stockpiles on cleared areas
6. Use the appropriate machinery for the task.

7. Plan vegetation removal (do not clear vegetation unnecessarily).
8. Topsoil should be stripped and stockpiled for use as soon as practicable.
9. Protect and maintain site erosion control measures, such as:
   a. replacing temporary cut-off drains at the end of the day.s work
   b. minimise exposed soil and slopes
   c. avoid damage to erosion control measures
   d. replace damaged erosion control measures, including silt fences,
   e. temporary bunds and straw bales
   f. ensure the works drain to the erosion/sedimentation control structures.
10. Ensure waste is controlled and disposed of correctly.
11. Clean equipment before moving to another site.
12. If unsure about any environmental controls contact the site supervisor.

4.6 Measures to Prevent Pollution

- ✓ Good construction site practice can help to control and prevent pollution. The first step is to prepare environmental risk assessments for all construction activities and materials likely to cause pollution. Specific measures can then be taken to mitigate these risks:
- ✓ To prevent erosion and run-off, minimise land disturbance and leave maximum vegetation cover.
- ✓ Control dust through fine water sprays used to dampen down the site.
- ✓ Screen the whole site to stop dust spreading, or alternatively, place fine mesh screening close to the dust source.
- ✓ Cover skips and trucks loaded with construction materials and continually damp down with low levels of water.
- ✓ Cover piles of building materials like cement, sand and other powders, regularly inspect for spillages, and locate them where they will not be washed into waterways or drainage areas.
- ✓ Use non-toxic paints, solvents and other hazardous materials wherever possible
- ✓ Collect any wastewater generated from site activities in settlement tanks, screen, discharge the clean water, and dispose of remaining sludge according to environmental regulations.
- ✓ Use low sulphur diesel oil in all vehicle and equipment engines, and incorporate the latest specifications of particulate filters and catalytic converters.

V. Green Concept

Considering the future population projections, utilization of resources, pollution and unstable climatic conditions, and in order to protect the environment and the wellbeing of the planet, something has to be undertaken that would contribute to the change of the current patterns of social and economic activities, and we all have a leading role to play in that change process. We need to adopt a holistic approach and green oriented thinking when considering the construction sector/industry.

Such an approach would include the following stages:

- ❖ Promotion of Awareness building on the *"GREEN CONCEPT"*
- ❖ Green Procurement
- ❖ Green Planning
- ❖ Constructing Green Buildings
- ❖ Utilizing Green Construction techniques
- ❖ Green Operation & Management
- ❖ Green Maintenance & Repairs
- ❖ Green Dismantling

Legislation and Governmental authorities alone cannot solve this issue. It is the change of our behavior and approach which is required.

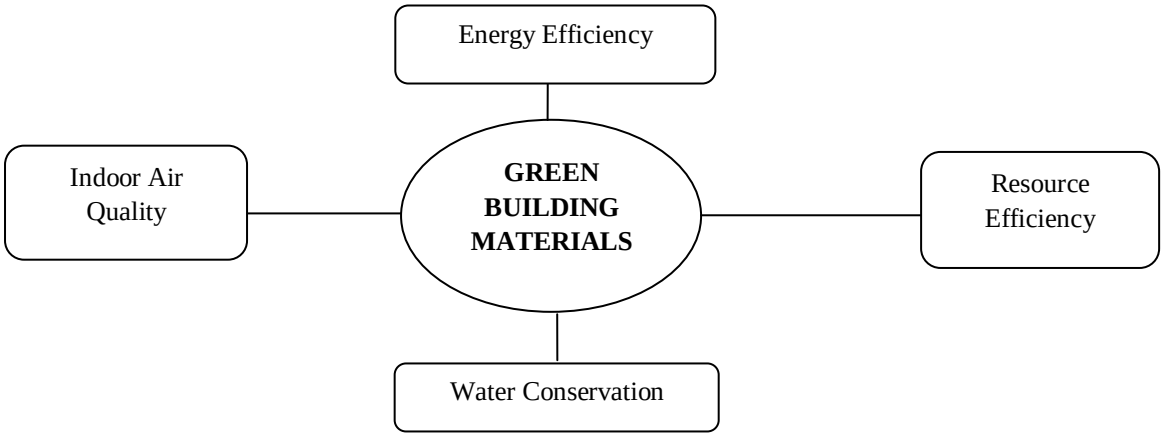
5.1 Green, Sustainable Construction and Development

Green construction is the practice of erecting buildings and using processes that are environmentally responsible and resource efficient. Green buildings limit their environmental impact by conserving as much energy and water as possible and are constructed of recycled or renewable materials in order to achieve maximum resource efficiency.

The concept of sustainable construction and green development incorporates and integrates a variety of strategies during the design, construction and operation of building projects. The use of green building materials and products represents one important strategy in the design of a building. It needs to be understood that sustainable construction techniques are different than good practices. Green building materials are composed of renewable, rather than nonrenewable resources. Green materials are environmentally responsible because its environmental impacts are considered over the life of the product.

Green building materials and green construction offer specific benefits:

- Reduced maintenance/replacement costs over the life of the building.
- Energy conservation.
- Improved occupant health and productivity.
- Lower costs associated with changing space configurations.
- Greater design flexibility.



5.2 Green material and product selection criteria

For green building material and product selection, the following factors are to be primarily considered.

- Products with identifiable recycled content.
- Products manufactured with resource-efficient processes including reducing energy consumption, minimizing waste (recycled, recyclable and or source reduced product packaging), and reducing greenhouse gases.
- Building materials, components, and systems found locally or regionally saving energy and resources in transportation to the project site.
- Salvaged, refurbished, or remanufactured: Includes saving a material from disposal and renovating, repairing, restoring, or generally improving the appearance, performance, quality, functionality, or value of a product.
- Select materials that can be easily dismantled and reused or recycled at the end of their useful life. Products enclosed in recycled content or recyclable packaging. Materials that are Durable and longer lasting.

VI. Role of Civil Engineer

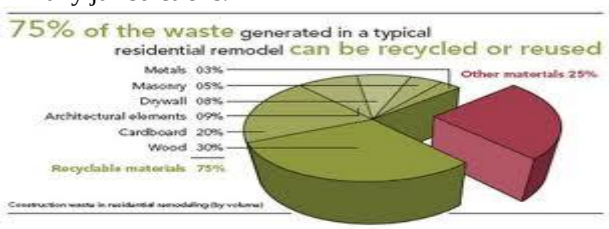
Civil engineers design and supervise the construction of roads, buildings, airports, tunnels, dams, bridges, and water supply and sewage systems. Their work requires them to consider many factors, from the construction costs and expected lifetime of a project to government regulations and environmental hazards. The major specialties of civil engineering are structural, water resources, construction, transportation, and geotechnical engineering.

The knowledge civil engineers possess allows them to be involved in just about every part of green building design. They might work on issues as diverse as erosion control and traffic flow patterns. By adopting green practices in every piece of a building, civil engineers can ensure that the final product is environmentally friendly.

VII. Concrete Recycling

Recycled crushed concrete being loaded into a semi-dump truck to be used as granular fill. Concrete recycling is an increasingly common method of disposing of concrete structures. Concrete debris was once routinely shipped to landfills for disposal, but recycling is increasing due to improved environmental awareness, governmental laws and economic benefits. Concrete, which must be free of trash, wood, paper and other such materials, is collected from demolition sites and put through a crushing machine, often along with asphalt, bricks and rocks.

Reinforced concrete contains rebar and other metallic reinforcements, which are removed with magnets and recycled elsewhere. The remaining aggregate chunks are sorted by size. Larger chunks may go through the crusher again. Smaller pieces of concrete are used as gravel for new construction projects. Aggregate base gravel is laid down as the lowest layer in a road, with fresh concrete or asphalt placed over it. Crushed recycled concrete can sometimes be used as the dry aggregate for brand new concrete if it is free of contaminants, though the use of recycled concrete limits strength and is not allowed in many jurisdictions.



VIII. HVAC

HVAC (heating, ventilation, and air conditioning) is the technology of indoor and automotive environmental comfort. The three central functions of heating, ventilating, and air-conditioning are interrelated, especially with the need to provide thermal comfort and acceptable indoor air quality within reasonable installation, operation, and maintenance costs. HVAC systems can provide ventilation, reduce air infiltration, and maintain pressure relationships between spaces. The means of air delivery and removal from spaces is known as room air distribution. These systems use very little energy but care must be taken to ensure comfort.

Also Natural ventilation is a key factor in reducing the spread of airborne illnesses such as tuberculosis, the common cold, influenza and meningitis. Opening doors, windows, and using ceiling fans are all ways to maximize natural ventilation and reduce the risk of airborne contagion. Natural ventilation requires little maintenance and is inexpensive.

The building environmental design standard aims to:

- provide the constraints concerning sustainability issues from the initial stage of the design process, with building and plant life cycle to be considered together with owning and operating costs from the beginning of the design process;
- assess the proposed design with rational criteria for indoor air quality, thermal comfort, acoustical comfort, visual comfort, energy efficiency and HVAC system controls at every stage of the design process;
- Iterate decisions and evaluations of the design throughout the design process.

IX. Conclusion

We need to understand that we have no option other than to consider sustainability in our construction practices. Sustainability is becoming a central concern for us all out of wider recognition that rising populations and economic development are threatening the earth's resources.

We have to adopt a green approach starting from planning, construction, operation and end use of a project/building. Constructing a green building alone will not solve the problems. By considering our building choices, we can easily increase the comfort, safety, and efficiency of our buildings without putting undue stress on our natural resources.

X. Recommendation

Government, industry and the Environment Agency all have a role to play in promoting environmental improvements and reducing the environmental impacts of the built environment, both in terms of construction and during the life of buildings.

Thus the project was concluded with the hope of Construction Industry can move towards Sustainable Development by adopting four major pillars:

- **Energy:** reducing energy consumption, being more energy efficient and using renewable energy and alternative technology.
- **Materials:** Choosing, using, re-using and recycling materials during design, manufacture, construction and maintenance to reduce resource requirements.
- **Waste Reduction:** Producing less waste and recycling more.
- **Pollution Reduction:** Producing less toxicity, water, noise and spatial pollution.

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