

Construction and the Environment

Eng. Rehan Ahmed

**Head, Waste Disposal Unit, Environmental Control Directorate, Public
Commission for the Protection of Marine Resources, Environment & Wildlife,
Kingdom of Bahrain.**

1. Introduction

Construction is a process that consists of building or assembling of infrastructure. Construction aims at making long live structures and buildings. 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 considered as 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).

Since the industrial revolution, the world has witnessed incalculable technological achievements, population growth and corresponding increases in resources' use. Building and construction activities worldwide consume three billion tons of raw materials each year or 40 % of total global use. No other industry in the world uses more materials by weight than the construction industry. Construction contributes 8- 10% of the global Gross Domestic Product, yielding an annual output of around US \$ 4.6 trillion.

2. Environment

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 renewables and non-renewables. 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. (Ref.1)

3. Environmental Impacts of Construction

Construction is mainly about making buildings for various uses like housing, industries, commercial centers, recreation, healthcare etc. An individual living in an urban environment almost spends 90% of his time in buildings, the rest is used commuting from one place to another, like moving from the residence to office to commercial centers, recreation centers and back to the dwellings. So, in short, it is a

journey between various buildings.

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. (Ref. 4)

In the USA, buildings are responsible for 72% of U.S. energy consumption, 38% of GHG emissions, 13.6 % of all potable water, 136 million tons of building-related construction and demolition debris.(Ref. 4)

The construction activities are straining the limits of the Earth's "carrying capacity"—its ability to provide the resources required to sustain life while retaining the capacity to regenerate and remain viable. We need to understand that our planet cannot support the current level of resource consumption associated with the Construction.

4. Construction and Pollution

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%.(Ref.5)

5. Construction Boom in the Gulf

Gulf nations are engaged in a relatively large development, especially on coastal areas in order to accommodate a fast-growing population at an annual growth rate of 2.1 per cent, is about double the world average rate.

According to the Middle East Economic Digest (MEED), there are currently 2,100 projects in gulf countries worth 3-trillion USD (Ref. 7). The total value of major projects in the GCC markets, account for about 78% of regional activities or \$2.3 trillion. It is expected that there will be an additional 200 billion USD worth of projects in the next 5 years for other mega projects. Bahrain is witnessed the highest growth, with the value of projects touching USD 78.49bn.

Furthermore, a total of 152 projects worth BD 87 billion will be underway in Bahrain in the coming years, whereby in construction industry will have 55 projects worth 22 billion dinars, Oil and gas industry 40 projects worth BD 30.6bn, Infrastructure 25 projects

worth BD 31.6bn, Leisure & tourism 25 projects worth BD 2.2bn and Health sector 7 projects worth BD3 20m. (Ref. 6)

As per the Bahrain's Economic development Board (EDB) forecast by the year 2020, approximately 263,536 housing units will be needed costing around 1.1 billion USD. By 2030, 346,718 housing units will be required costing around 242 US\$/ Year till 2030. The current deficit of housing units is almost 40,000 units which are increasing with time, while the current housing stock is around 145,181 units. This shows that only in housing sector in Bahrain, a lot of housing construction is required. (Ref. 6)

6. Construction Impacts

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. Life-Cycle Assessment, Eco-Labeling and Embodied Energy Audits all can help choosing materials and assess the balance between short-term costs and long-term environmental, social and financial benefits.

Resource depletion, waste and recycling are other major impacts of construction. Material extraction of the primary resources causes major environmental impacts through loss of habitat and ecosystem, damage to the landscape, potential subsidence problems, release of methane, transportation of material, Construction and Demolition wastes and its disposal or processing/recycling of waste.

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.

7. Changing our concept on Construction

Considering the future population projections, utilization of resources, pollution and unstable climatic conditions, and in order to protect the environment and the well-being 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:

- i. Promotion of Awareness building on the 'GREEN CONCEPT'
- ii. Green Procurement
- iii. Green Planning
- iv. Constructing Green Buildings
- v. Utilizing Green Construction techniques
- vi. Green Operation & Management
- vii. Green Maintenance & Repairs
- viii. Green Dismantling

Legislation and Governmental authorities alone cannot solve this issue. It is the change of our behavior and approach which is required. We have to improve our 'vision' for construction rather than making green buildings only as per foreign standards.

8. Green & Sustainable Construction & Green Development

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' (Ref. 2).

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.

Using green building materials and products promotes conservation of dwindling nonrenewable resources internationally. In addition, integrating green building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these building industry source materials.

9. Green material and product selection criteria

We need to radically reduce our demand on haphazard and un-planned construction and constructing buildings not of beneficial uses and need to change the way we consume such materials. This is particularly as regards how we build. It means using less of these materials by building more simply, with more local and plentiful (i.e. sustainable and renewable) materials and with less waste.

Product selection can begin after the establishment of project-specific environmental goals. The environmental assessment process for building products involves three basic steps of Research, Evaluation and Selection (Ref 3).

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

i. Resource Efficiency : It can be accomplished by utilizing materials that meet the following criteria:

- Products with identifiable recycled content.
- Materials harvested from sustainably managed sources.
- 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.

ii. Indoor Air Quality (IAQ): People are exposed to a range of chemicals arising from furnishing and finishes inside the buildings. It includes physiological and psychological reactions.

Indoor Air Quality is enhanced by utilizing materials that meet the following criteria:

- Low or non-toxic: Materials that emit few or no carcinogens, reproductive toxicants, or irritants.
- Minimal chemical emissions: Products that have minimal emissions of Volatile Organic Compounds (VOCs).
- Low-VOC assembly: Materials installed with minimal VOC-producing compounds, or no-VOC mechanical attachment methods and minimal hazards.
- Moisture resistant: Products and systems that resist moisture or inhibit the growth of biological contaminants in buildings.

- Healthfully maintained: Materials, components, and systems that require only simple, non-toxic, or low-VOC methods of cleaning.
- Systems or equipment: Products that promote healthy IAQ by identifying indoor air pollutants or enhancing the air quality.

iii. Energy Efficiency: This is to be investigated and all products and appliances should be chosen which are energy efficient and last longer like LED lights.

iv. Water Conservation: It is an important factor. Only water conserving taps, fittings, appliances and gadgets are to be installed which saves water. Low flow showers, taps, flushing tanks are to be installed and used.

v. Affordability: This is to be considered based on the building type, location and funds available.

10 Conclusions

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.

We have to consider the sustainability concept as highlighted in the Brundtland Commission, 1987 Report (Ref.8) and go for green development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

11. Recommendations

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. The 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.

It is recommended to utilizing the Life Cycle Assessment (LCA), which is an internationally established approach for analyzing [the] environmental impacts of products and processes. Finally, the development should be located in the right place and in the right way reducing construction pollution and waste.

12. References

1. D.M. Roodman and N. Lenssen, *A Building Revolution: How Ecology and Health Concerns are Transforming Construction*, Worldwatch Paper 124, Worldwatch Institute, Washington, D.C., March 1995, p. 5.
2. Ross Spiegel and Dru Meadows, *Green Building Materials: A Guide to Product Selection and Specification*, John Wiley & Sons, Inc., New York, 1999.
3. Lynn M. Froeschle, "Environmental Assessment and Specification of Green Building Materials," *The Construction Specifier*, October 1999, p. 53.
4. U.S. Environmental Protection Agency
5. *The Impacts of Construction and the Built Environment*, Wilmont Dixon, Document No. FM-RE-07 Revision B, September 2010.
6. 225,000 homes may be needed by 2030, *Gulf Daily News*, November 22, 2011.
7. *Transformations of Regional Economic Governance in the Gulf Cooperation Council* by Fred H. Lewis, Center for International and Regional Studies, Georgetown University School of Foreign Service in Qatar, 2012, occasional Paper No.12.
8. *Our Common Future, Report of the World Commission on Environment and Development*, Oxford University Press, 1987.