SUSTAINABILITY IN CIVIL CONSTRUCTION AND THE ROLE OF CIVIL ENGINEERS

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ABSTRACT
With the increase in global warming and climate change, sustainable construction is becoming a prime focus for the world. This paper focuses on the need of the sustainable construction with respect to the present world scenario, what are the benchmark of a good sustainable construction, what have been done in past in civil engineering, what other steps that can be taken for the sustainable construction and the role of civil engineer in a sustainable design. With this paper an attempt is made to identify the role of students in sustainability, method to introduce student to sustainability, importance of critical thinking to achieve the aim and how such thinking can be cultivated in civil engineering student.

KEY WORDS: Sustainable construction, civil engineering, green buildings, Sustainable development

INTRODUCTION
Sustainability means full filing the present need without compromising with future generation needs. Brundtland report (1987) gave the precise definition of sustainable development as “meeting the needs of present without compromising the ability of future generation to meet their own needs”. Conventionally the prime focus of a civil engineer is building strength and lifespan, but with present changing scenario, awareness and responsibility toward environment the characterization of civil engineer has changed from “The one who directs nature great power source to convenience and use of man” to “the guardians of built and natural environment” (J.A. Ochsendorf, 2005 Sustainable Engineering: The future of Structural Design). From the inception, engineers have focused on economy, strength and long life span of the construction and while the sustainability of the construction been overlooked. On analyzing, a building operation is responsible foe for 40% energy use, contributes 38% of U.S CO₂, cement production account for 8% CO2 emission (Lisa Aukeman;Sustainability and Structural Engineering). Carbon di oxide is produced by carbon oxidant present in cement clinker production process which is the cement’s major constitute and CO2’s non combustion source in industrial manufacturing, contributing 4% to total global emission With context to developing country like India, which places 4th in CO2 emission and also the second largest producer of cement dominating 5% of world’s share. (Trend in CO2 emission 2012 report, PBL Netherland Environmental Assessment Agency). This CO2 emission was increased by 7% in 2013 ((Trend in CO2 emission 2013 report, PBL Netherland Environmental Assessment Agency).
Looking at these trends it’s needless to say that the need of sustainable construction cannot be avoided.
CHARACTERISTICS OF GOOD SUSTAINABLE BUILDING.
The building considering social, environmental and economic factors is believed to be fully sustainable building. These brief feature includes:

a) Use of Pollution Free Measure While Manufacturing. Use of such method will lead to environment sustainability.

b) Reducing waste production during manufacturing. This leads to increasing resource efficiency of building materials. For example salvaging existing steelwork is far desirable to recycling because of high energy requirement for recycling steel.

c) Embodied Energy Reduction. Embodied energy is the energy required in production of a material, this also include raw material collection. Use of processes that save energy will lead to reduction in embodied energy reduction. Natural material have less embodied energy, hence civil engineer must explore alternative in natural material. For example Strawbale construction, consisting of straw, a plant fragment is nonliving and left over after harvesting is an epitome of sustainable construction.

d) Construction Waste Reduction. This saves landfilling space and cost saving.

e) Use of renewable energy system. Designing and constructing building in such a way that it eliminate or compensate the traditionally used methods for cooling, heating etc.

f) Longer Life. This include low maintenance cost, durability of material, reusability, recyclability.

Other common point includes Water conservation, i.e. use of waste water or water harvested from rain in use, use of nontoxic materials, use of renewable energy systems.

CIVIL ENGINEERING ORGANIZATIONS AND SUSTAINABILITY

a) The American Society of Civil Engineers (ASCE)
ASCE acknowledges that environment gets effected by structure and stresses on strengthening and broadening the education of engineers and have laid some policies like

- Encouraging various political, social, economic and technical aspects related to sustainable development.
- Improving skills, knowledge and information to facilitate sustainable future.
- Preferring economic methods that use natural resources
- Encouraging multidisciplinary, integrated and multi objective goals in every step of design and construction.
- Promoting performance based standard and guidelines.

b) US Green Building Council
It has documented its own certificate process in form of Leadership in Energy and Environmental Design (LEED). LEED has its rating system given by judging building in following areas

- Sustainable Sites
- Water Efficiency
- Energy and atmosphere
- Material and resources
- Indoor environmental quality
- Innovation and design process
INDIA’S STAND ON SUSTAINABLE CONSTRUCTION

Government of India has taken several steps toward sustainable construction in which major step is formation of green building policy by Government of Kerala. The goal of the policy are

- Constructing self-sustainable building consuming minimum energy.
- Popularizing and incorporating green building concept.
- Issuing guideline to various organization in building sectors to adopt the policy
- Implementation of green conservation code.
- Enhancing occupants health and comfort
- Maximizing reuse and reducing damage to environment

The policy also include getting LEED certificate depending on type of building as follows.

<table>
<thead>
<tr>
<th>Building type</th>
<th>Area</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Below 2500 sqm.</td>
<td>Minimum requirement for a 3star under SWAGRIHA or Silver under LEED</td>
</tr>
<tr>
<td>Medium</td>
<td>2500 Sqm and above</td>
<td>Minimum requirement for 4Star under GRIHA or Gold under LEED</td>
</tr>
<tr>
<td>Large</td>
<td>More than 1,50,000Sqm</td>
<td>5 Star under GRIHA or Platinum under LEED</td>
</tr>
</tbody>
</table>

(Green Building Policy, Government of Kerala)

ROLE OF CIVIL ENGINEER STUDENTS IN SUSTAINABLE DESIGN.

Civil Engineering student should be inspired from early stage toward sustainable construction. They must be encouraged to think out of the box, develop critical thinking and facilitate good judgment. This can be done by giving them more exposure to practical field based problem and allowing them to come up with other innovative solution rather than going with traditional solution, and then analyzing solution with technicality, feasibility and necessary aspects. They must understand and know why a specific judgment appear to be good and must be able to unambiguously defend the justification for making choice. The necessity for informed decision making is another important principle in sustainable development which should be cultivated in an engineering student. (Thomas J. Siller, 2001).

CONCLUSION

With global warming increasing, ice cap melting and climate changing, its needless to say sustainable construction is the demand of current scenario. Civil engineer must opt for more environment friendly materials, should bring recyclable material for use and must come up with creative solution to support sustainable design practice

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