

# Steel as a Sustainable Material: A Discussion

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## ABSTRACT

In present trends of global warming, depletion of natural resources, increase of carbon emissions and many more reasons, the term 'sustainability' has come into major prominence. We had utilized all the benefits that nature has given to us; it's our duty to transfer more of its beauty to our future generations without depleting our own resources. This is the brief meaning of sustainability. The key word sustainability and its importance have been utilized in every branch of science and engineering. In construction industry, use of sustainable materials and practices had started in each and every aspect. The organizations like USGBC in US and IGBC in India, etc., had evolved and introduced their plans and efforts of developing a sustainable world. Many materials had been developed for sustainability and steel is one which has major advantages. Steel is recyclable, earthquake resistant, non-combustible, does not warp & creep, non-vulnerable to terminations, sooner time of construction, cost reduction etc. It's has great importance as green building material. Steel provides benefits in all aspects like socially, environmentally and also financially. Though it provides these many advantages, it is mostly confined to hilly areas. Its utilization is confined to lesser extents. Its value has to be known and further researches has to be done, to utilize it in all construction types in major way and also to be more structurally stable..

## Keywords

Steel, Sustainability, Steel construction, Benefits, goals.

## 1. INTRODUCTION

Our environment and nature is what we live today. Due to our own actions, nature has been depleting to the major extents. All the industrial, human and natural activities contribute to various effects, positively or negatively, affect environmental future. The main environmental effects include Global warming, Acidification, Eutrophication, Ozone layer depletion, Toxicity and also resource depletion. This has to be noted and major steps have to be laid to provide better future for further generations. The construction industry can be accepted as one of the important users of materials and energy i.e. usage of natural resources. That is why it gains a big importance for this sector to consider energy savings, renewable raw material usage and minimization of the pollution as much as possible.

## 2. IMPORTANCE OF SUSTAINABILITY & SUSTAINABLE CONSTRUCTION

We know there are many reasons for all these environmental effects, like loss of biodiversity, pollution and population etc.,

there is a major need for safe and better future. The term 'sustainable' mostly defines safe and better practices which benefit the society socially, financially and also environmentally, without depleting our own resources. This has been introduced in all human practices. Mainly in construction industry it has huge need. Thus later Green buildings had evolved with advantages of sustainable construction. Green buildings solutions range of sustainable material are a result of cutting edge research, a keen understanding of consumer needs and its responsibility towards the environment. The organizations like USGBC and IGBC had some standards and certifications for sustainable practices. They set new global standards with their aesthetic appeal, exceptional functionality and extreme durability. The use of these revolutionary products could transform the way the construction industry does business.

## 3. STEEL – A SUSTAINABLE MATERIAL

Steel is considered as eco-friendly material due to various reasons like durability, cost effectiveness, earthquake resistance, fire resistance, and also structural performance, etc. Not only these it's further more advantages indicate as why it is chosen as sustainable or green building material. They:

- will not warp, creep or crack
- are non-vulnerable to terminations
- does not expansion and shrinkages during moisture
- Are fire resistant.
- Are earthquake resistant.
- Prone to extreme environmental conditions like cyclones, heat, snow, salt etc.
- Are recyclable leading to less wastage and safe environments
- Help in shorter construction time.
- Resource efficient.

## 4. BENEFITS OF STEEL CONSTRUCTION

The sustainable construction practices include:

- Maximize Durability
- Minimize quantity of materials
- Maximize The Energy Efficiency and Renewable Resources.
- Maximize Future Recyclability and reusability.
- Maximize the maintainability
- Maximize the recycled content
- Maximize the use of local materials/regional material
- Minimize embodied energy
- Minimize the use of hazardous natural and synthetic chemicals.

The steel construction strategy:

#### 4.1 FINANCIAL BENEFITS – COST EFFICIENCY

##### 4.1.1 Recyclability - Material Efficiency

Every piece used in steel construction, can be recycled. The recycling rate of steel is almost 98%. This results in less scrap and wastage leading to land use and construction site. This indicates minimizing quantity of materials.

##### 4.1.2 Reusability

Steel can be recycled over and over again and can be used as new steel. These steel will still be in use hundreds of years from now, lessening impacts on future generations. Steel when recycled loses none of its inherent properties, and can be reused further in cars, cans, pedestrian bridges, cladding components, framing components, wall elements, and etc. products.

##### 4.1.3 Energy efficiency

Steel provides thick layers of insulation and airtight solutions without compromising structural integrity and this cuts costs on energy bills. An insulated steel home can save 30% off energy bill.

##### 4.1.4 Durability

Steel is extremely prone to severe and worse environmental conditions and exposures like hurricanes, earthquakes, heat and snow, fire resistant, non-vulnerable and also highly resistant moisture which indicate high durability. They have highest strength-to-weight ratio of any building material. Thus major utilization is seen in hilly areas.

#### 4.2 SOCIAL BENEFITS

Steel construction is a dry construction, low emitting materials, controlled and safe processes leads to better indoor environment quality and social well-being of the society. As a big part of steel construction like prefabrication of frames, structural elements, modular units, etc. are done in factory, off the construction site providing safe working environments and facilitate accurate and quality workmanship.

#### 4.3 ENVIRONMENTAL BENEFITS

Usage of recycling steel in all practices leads to eco-friendly impact and developing safe and better help in future generations.



Figure 1: Impact of steel

#### 4.4 FURTHERMORE BENEFITS

Not only the advantages discussed above, there are many more advantages of steel construction:

##### 4.4.1 Transport

With utilization of local production, steel is delivered to construction sites easily cutting down transportation charges and also usage of construction site as they can be delivered just before the start of construction.

##### 4.4.2 Demountability

##### 4.4.3 Less span of construction

##### 4.4.4 Flexibility, etc.

#### 5. MEETING GREEN BUILDING CODES AND STANDARDS

Steel construction, by now is considered as sustainable construction which includes sustainable design, construction phase, operations and maintenance and end of life. In many regions, still wood constructions are being done thinking as sustainable leading to various disasters like increase in depleting forests, increase in carbon emissions, reduction in fresh oxygen, etc. results. Cold-formed steel is positioned to meet the highest sustainability standards as it is recognized in all major green building and rating programs, including the National Green Building Standard for residential buildings and the US Green Building Council’s LEED (Leadership in Energy and Environmental Design) program. Even Indian Green Building council (IGBC) has developed its standards in construction practices of buildings. IGBC residential building rating system includes various levels.

Table 1: IGBC threshold criteria for certification levels

Certification Level	Individual Residential Unit	Recognition
Certified	38-44	Best Practices
Silver	45-51	Outstanding Performance
Gold	52-59	National Excellence
Platinum	60-75	Global Leadership

Table 2: IGBC rating system for sustainable construction practices

Category	Total points	Points for cold-steel framing
Site selection and planning	9	1+1(partial)
Water efficiency	11	
Energy efficiency	22	
Materials & Resources	13	2+2(partial)
Indoor Environmental Quality	15	
Indoor& Design Process	5	

## 6. CONCLUSION

By knowing need for protection of natural resources and safe environments, sustainable practices are to be utilized in every manner. As a resource-intensive industry, the construction industry constitutes an important part in environmental impacts which have badly influences on human health and natural balance. The usage of steel is to be developed in most constructions. Though there are many advantages of steel, there is still lack of knowledge in the industry. Still further applications and further research like improvising the strengths, less maintenance factors including non-corrosion ability, utilization in high rise buildings not only confining to mid-rise buildings and eco-friendly production, etc. has to be developed. Major utilization of steel in constructions in all aspects is seen in countries like USA, though green building practices started in India, it still lacks behind. Thus, knowing the advantages of steel and improvising the disadvantages will help in beneficial not only present us but also future generations in all aspects of our nature.

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