Overview on Steel Structures

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Steel is the most preferred metal for the construction of large structures such as bridges, space frame structure, multistoried buildings, industrialbuildings and residential buildings. There are three main types of steel construction - conventional steel fabrication, bolted steel structure construction and light gauge steel structure construction. Steel structure construction has numerous advantages over concrete construction.

The steel has incredibleversatility. From the ability for structural steel to be molded into virtually any shape to its exterior ability to yield shingle-sequel roofing patterns and wood-like siding, steel's versatility is part of what is making it such an attractive option for the residential construction market.

Architects and designers like steel's ability to let their artistic imaginations run wild, while still having the ability to design and construct a building that is both safe and resilient. This also allows for the versatile design of large, clear span buildings such as airplane hangars, warehouses, agricultural buildings and indoor arenas. It also permits for the construction of skyscrapers, the tallest of which stands in Dubai at 2722.4 feet (829.8 m) tall. The commercial sector no longer corners the market on steel buildings, either.

This design versatility and flexibility is now being touted in the residential sector as well. Consider a family who wants to knock out a wall for a remodel or renovation, only to find that a load-bearing wood pillar is an essential component. Now, they have the option of running a steel beam across the ceiling, opening the space up and negating the need for a structural beam below the ceiling line. Additionally, steel and metal are used for siding and roofing materials that far outlast their wood counterparts.

There are multiple reasons why steel makes an attractive building option from start to finish, not the least of which are:

- Sustainability
- Affordability
- Durability

From full-throttle metal building projects, to hybrid construction projects that leverage the attributes of both wood/Concrete and steel, the modern builder has a wealth of options to choose from.

Steel is a versatile building material, which has led to its inclusion in nearly every stage of the construction process from framing and floor joists, to roofing materials. Here are some of the main benefits that make structural steel such a reliable choice.

Steel is lighter than concrete

This may seem surprising at first, because if you weigh a 2x4 of wood and a 2x4 of steel, the steel will weigh more as the result of its density. When it comes to framing, however, the design of a steel I-beam will almost always cause it to be lighter than the lightest in comparison to structurally sound wood beam design. A steel I-beam weighs less than Glulams, LVL, and Parallam beams.

The total dead load of concrete conventional buildings is much higher than steel structure buildings. So Steel structure building foundation are lighter than RCC buildings foundation. It will be at least 20% saver cost than RCC building foundation.

In addition to decreasing the labor required to build with steel, the lighter-weight advantage reduces materials shipping costs, and can also simplify the design of a building's foundation and other structural support systems, which can further reduce project budgets.

Build faster with Steel

Time has always equaled money, but it seems like this high-tech era of ours has made it so that every client wants their building to come in within budget and ahead of schedule. Fast-tracked projects can be a nightmare for architects and construction crews -mainly because taking shortcuts can lead to unsafe building practices.It saves project duration 1/3 than RCC concrete buildings, which means saving of 2/3 project duration time.

Steel parts are pre-engineered to a specific design in the manufacturing plant and are shipped out, ready to be erected. This speeds up construction time significantly, making it possible to complete large-scale projects in a matter of weeks.

Because the fabrication process is highly quality-controlled, Project Managers can place their attention on other issues and the pre-cut, ready to assemble parts eliminate the need for measuring and cutting on site. This also takes the element of human error out of the equation, reducing the amount of time spent assembling something only to find out it needs to be re-measured, cut and installed again.

In addition to project time and budget issues, a faster construction timeline also reduces the amount of time your construction project impedes traffic, affects the flow into and out of surrounding businesses and any water or utility disruptions to nearby buildings.

Save money with steel

Much of the cost savings you'll gain can be inferred from the labor and cost benefits of decreased construction time. However, building with steel also saves money via other first time and lifetime savings.

"Steel can be recycled: Rather than paying landfill fees for non-recyclable construction waste, you will be able to recycle steel and metal building components. Due to public interest in decreasing unnecessary construction waste, most waste removal companies have subsidized programs allowing them to pick up your steel and metal building waste at no cost to you.

- Because steel is so durable: and requires so little maintenance, it is a more economic choice for building owners. Maintenance fees, repairs and replacements are minimal - even over the course of 50 years or more - saving building owners tens of thousands of dollars over the course of the building's lifetime.

  It can withstand extreme forces or harsh weather conditions, such as strong winds, earthquakes, hurricanes and heavy snow. They are also unreceptive to rust and, unlike wood frames, they are not affected by termites, bugs, mildew, mould and fungi. Additionally, they are more fire-resistant compared to wooden frames.

  Utilising steel supplies in building residential, commercial or industrial structures is definitely a worthy investment.

- Innovation in steel production: combined with greater competition to meet rising steel demands, has brought steel prices lower than they've been in twenty years. According to the American Institute of Steel Construction, "In 1980, 10 man-hours were required to produce a single ton of steel. Today that same ton of structural steel requires substantially less than a single man-hour." Thus, these cost savings can be being passed on to the consumer.

- Sustain ability against seismic: Due to a steel structures' almost unrivaled ability to withstand high winds, heavy snow loads, fire and seismic activities, combined with their resistance to pests and decay, insurance companies often offer lower premiums on policies underwritten for metal buildings.

- Faster construction times: means fewer interest payments to the lender, who typically requires that interest-payments are made through the duration of the construction process.

- Cost-effectivity: It is light-weight compared to timber, which makes it easier to transport and thus, reduces fuel costs and accelerates project schedules. Aside from this, it is also energy efficient and can be recycled, creating minimal raw material wastes.When bundled together, these cost-saving benefits make steel one of the most affordable building products on the market.

It's environmental friendly

Steel is made from recycled materials and can be recycled at the end of its lifespan, one of the many reasons why it can earn builders points toward major green building certification programs. According to the Steel Recycling Institute:

- 80 million tons of steel are recycled each year, making it the world's most recycled product.
- Since 1990, the steel industry has reduced energy intensity per ton of steel produced by 28% and CO2 emissions by 35% per ton of steel shipped.
- Reductions in energy use and CO2 emissions are rapidly reaching the limits defined by the laws of physics.

When combined with other design enhancements, steel buildings are incredibly energy efficient. The connections between high-quality, prefabricated steel parts are so exact that with the addition of adequate insulation, they are air-tight and comfortable, ensuring the building has a completely sealed envelope. Roof panels are primed and ready to host a solar array and cool metal roofing products dramatically decrease solar heat gain, further increasing energy savings.

Adaptability

Steel can be adjusted or changed according to the owner's requirement. For instance, wall frames made from this type of material can be repositioned or altered easily in order to widen the space or create a new interior building layout. This ability to adapt to changes allows for easier expansions, at the same time helps extend the lifespan of the structure.

Versatility and Beauty

It offers a stylish way of creating large, column-free interiors, thereby giving the building a sense of openness. It's also malleable, giving structural designers the freedom to explore ideas in terms of creating stylish shapes and textures in order to make the building distinct. Steel can be cut and shaped into an incredible variety of shapes and sizes, and the steel will not buckle, warp, distort, or splinter. You may notice, if you ever go to a contemporary art museum, how many sculptures are made out of steel, thanks to its ability to shape practically any way the designer wishes.

Buildings with steel structural components can be eye-catching and unique with an extra artistic flair. Steel can also be designed to mimic other materials and textures such as shingles and wood siding so you don't need to sacrifice certain visual appeal.

Constructability

" The strength, stiffness, toughness, and ductile properties of structural steel allow it to be fabricated into an endless variety of shapes.

" Steel structures are assembled by bolting or welding the pieces together on site as soon as they are delivered as opposed to concrete, which takes weeks to cure before construction can continue.

" Distribution of a building's compression and tension stress among steel beams allows architects more freedom with design space and the ability to make last minute alterations.

Safety

- Even though steel is a noncombustible material, the International Building Code requires that it be completely coated in a fire-resistant material as its strength and integrity become significantly compromised in the instance of a fire.
- Water resistant coatings are also advisable to prevent structural steel from corroding. Fire-resistant coatings are typically also water resistant.
- Structural steel lacks the porosity necessary for mold and mildew growth, making it an ideal choice for residential buildings.
- Off site fabrication and fast component assembly makes structural steel inherently safer to manage at the construction site.
- Steel is endlessly recyclable, making it also safe for the environment.

1. Maintenance cost - steel structures are susceptible to corrosion when exposed to air, water and humidity. They must be painted periodically.
2. Steel has very small resistance against fire as compared to concrete. There has fire resistance paint. We can do fire resistance design accordingly and install firefighting system.
3. Fireproofing cost' Steel is incombustible material however its strength is reduced tremendously at high temperatures due to common fires. Need push to the government for duty free for fireproofing materials and Machine.
4. Susceptibility to buckling' as the length and slenderness of a compressive column is increase its danger of bucking increases.
5. Fatigue -The strength of structural steel member if this member is subjected to cyclic loading. Need to do perfect design.
6. Brittle - Under certain conditions steel may lose its ductility, and brittle fracture may occur at places of stress concentration. Need used quality ensured materials.
7. Steel cannot be mold in any direction you want. It can only be used in forms in which sections originally exists. But can do design and fabricated in factory.
8. Has a high expansion rate in changing temperatures. This problem can control

BANGLADESH PERSPECTIVE

Present scenario of Steel structured building in Bangladesh

Bangladesh is one of Asia's leading emerging steel markets and has a growing need for raw materials and steelmaking technologies. Steel structured buildings started in 1984 with the inception in Chittagong Export Processing Zone, and are now a favorite amongst Industrialists. Steel structured buildings now have a strong hold in Bangladesh's construction sector. Steel buildings are metal structure fabricated with steel with the internal support along with exterior cladding, as opposed to steel framed complexes which generally work with other materials with regard to floors, walls etc.

A pre-fabricated steel structure is now being used for different purposes such as setting up factories, multi-storied buildings, power plants and bridges (Craftex Builders, 2016). According to industry insiders, the segment produces an annual turnover of over BDT 10.00 billion. The main competitive advantage of this industry over the more traditional RCC building construction is the amount of time it saves. A typical 5 story RCC building takes 2 years to complete, whereas, the same building can be made in 6 to seven months of time. Moreover, most of the work is finished in the builders' premises, while the only assembly is done on-site. This technique of construction also offers a significant cost advantage, compared to RCC buildings which cost BDT 2,500.00 per square feet whereas, steel buildings cost only BDT 250.00 - BDT 1,000.00 per square feet. This cost increases in case of high rise buildings, but the main target of steel buildings is of medium height with a large area (Khan, 2009). Local steel-building makers are expecting a bright future for the pre-fabricated building sector as an increasing number of conglomerates, including foreign companies, are setting up such structures for industrial use. The demand for steel buildings is increasing in the country as it needs low investment, less time, and provides high safety (Sucre: Engineering Credit Rating Ltd.)

Market Size and Share at present in Bangladesh

The Pre-engineered steel industry of Bangladesh has shown remarkable success in the construction sector. There are approximately 130 more big and small PEB companies doing their business in local market, 30 companies of them are Steel Building Manufacturer Association of Bangladesh (SBMA) members. The mission of this industry is to encourage overall development and making a contribution to National Exchanger to work economic development of the country. The steel Structure Manufacturing Association of Bangladesh (SBMA) are leading the steel construction market, and 95% market shear owned bytheir members.

Production

The Bangladeshis company has enough production capacity to meet there market demand. Most of them are well-equipped by modern machinery and technology. The Pre-engineered steel Industry is mostly involved in buildings: High rises, Multi-story Buildings, industries, Workshop, Warehouse Housing, Training Center, Gymnasium, Basketball Court, Swimming pools, Markets Shopping center, Bus Station, Police station Border Posts, Grain storage, steel framed commercial buildings and waste/recycling facilities, commercial showrooms, distribution centers, restaurants, CNG stations, Fruit and vegetable Storage, Cold Storage, Equipment storage, Military Applications, Aircraft Hanger etc

Import

Bangladesh imports about 250,000 tons of hot-rolled coils, HR steel plates, steel coils, special steel, pipes etc. Materials are imported from a variety of countries that includes Australia, Japan, China, India, Korea, Vietnam,Canadaetc. (Sucre- The Daily Star, 2015)

Export

In the last five years, the country exported prefabricated building materials worth around $50 million, mainly to Sudan, KSA, Pakistan, India, Nepal and the UAE African Countries. Local steel-building makers, however, said they are now facing an uneven tax policy as they have to pay more than 60 percent duty for the import of raw materials. They urged the government to reduce the tax rate for the development of the sector (Sucre-Department of Research | Emerging Credit Rating Limited).

Demand and location

Presently, the annual demand for prefabricated steel buildings in Bangladesh is around BDT 20,000 million, growing at more than 35% for the last several years. Local companies meet around 85%-90% of the demand and the rest is imported. Prefabricated buildings consist of several factory-built components or units that are assembled on-site to complete the unit. The factories made of prefabricated buildings are now mainly located in Gazipur, Narayangonj, Comilla, Chittagong, Manikganj and Savar.

The Top 10 Steel Producing Countries In The World

Serial	Country/Region	Crude steel production (million metric tons, data 2015)
1	People's Republic of China	803.83
2	Japan	105.15
3	India	89.58
4	United States	78.92
5	Russia	71.11
6	South Korea	69.73
7	Germany	42.68
8	Brazil	33.25
9	Turkey	31.52
10	Ukraine	24.8