

BOOSTING CONSUMPTION OF STEEL-CHALLENGES AND OPPORTUNITIES

INTRODUCTION

Steel and Cement ratio, as it stands out in India is approximately 0.3. In many developed countries the same is as high as 1.5. So, apparently there may remain a space where steel may find its use. That leaves ample room for promotion and thus increase in consumption of steel in infrastructure in the country.

OPPORTUNITIES

SECTORAL USE OF STEEL BASED STRUCTURES

ROADS AND HIGHWAYS

National and State Highways play a major role in connecting the remotest corners of the country. Bridges, culverts serves as the connection for physical movement.

Here opportunities develop in changing to steel bridges in place of conventional RCC bridges, wherever possible because of cost advantage in terms of life cycle, quicker installation and longer life span.

Probable opportunities for Steel Intensive Infrastructure for Roadways are:

- Deployment of crash barriers of steel across the hilly roads to prevent fatal accidents
- Development of Skywalks, Foot Over



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bridges made of steel across roads in intersections with congested towns/city

- Creation of high strength Continuous Reinforced Concrete Pavement (CRCP) in monsoon prone areas - Will help in enhancing the service life. Steel concrete composite construction has better seismic resistance because of high ductility of Steel.
- Development of bridges over rivers / streams with steel for shorter lead time, longer life durability and higher design comfort.

Crash Barriers



Initiatives are being taken to upgrade the existing bridges and existing pavements to steel based bridges and steel reinforced pavements. Consumption here gets a boost up. Moreover the steel crash barriers are being used at accident prone zones add to the use of steel. Statistically speaking, there are over 1 lakh bridges in the country. After undertaking a "Conditions survey" conducted by Ministry of Road Transport and Highways (MoRTH) for rehabilitation/reconstruction it is found that around 1500 road bridges need rehabilitation.

Crash Barriers





Sky Walk

These items generally support Jetties. Piles thus envisaged may be made with hollow profile made of steel. It may be used there as these can be installed very fast with Vibro hammers and also withdrawn easily in case of relocation/ dismantling. They can be of great use for temporary structures. The strength and stability of these Steel hollow sections may be enhanced by filling the inner hollow part with concrete.

Steel sheet piles is another item which finds its use in this sector also. These piles are manufactured in the country in U formation and Z formation, by the major producers and can be used extensively in Port construction, as is being done Globally for creating Permanent and temporary retaining walls, in place of concrete Diaphragm walls / Slurry walls, which take longer time and cannot be reused / recovered.

Areas of Increasing Usage of Steel in Ports and Harbours

- Steel Tubular Piles (Vertical / Rakers) in Jetties, Wharves, Crane Rail Supports
- Steel Superstructure for Jetty Deck and approach trestle to offshore Jetties and Platforms
- Steel Sheet Piles in Bulkheads, Caissons (Breakwaters, Dolphins)
- Offshore Structures – Platforms, Navigation Buoys / Towers
- Onshore Navigation Lights / Towers
- Fender Pads



PORTS AND HARBOURS

This sector requires Large span structures like Warehouses, Transit sheds, Cold storages in the port area Technically speaking the said structures should be exclusively be with steel. The advantage which can be foreseen is that they can be relocated/ dismantled/ expanded with least time if or as and when required. Following structures may also be considered with Steel:

- Office Buildings
- Workshops
- Substation Structures
- Yard Gantry Structures
- Container Stack Yards / Reefer Stations (Service Structures)

Large diameter Piles is another item which may find demand in this sector.



Sheet Piles

- RoRo Terminal Ramps
- Floating Docks
- Lock Structures, Lock Gates, Keel & Bilge Blocks, Slipway, under Carriage and Ship Haulage Structures
- Conveyor Structures

RAILWAYS

Usage of steel in railways is limited to laying of railway tracks (permanent way), rolling stocks, wagons, platforms and coaches. Efforts are being made to increase the steel usage in making railway station, foot over bridges, rail coaches, construction of steel-based railway colony buildings especially in seismic prone areas, construction of dedicated freight corridors & superfast rail corridors and construction of more steel bridges for saving time & capital expenditure.

DEFENCE SECTOR AND BORDER MANAGEMENT

Special-grade steels have a wide range of applications in land and naval defence system of the country. Development of these special grades of steel indigenously would also lead to substitution of imports and save significant foreign exchange.

Indigenous steel can be used in following applications of defence sector:

- Armour plate for ballistic protection
- Advance naval destroyers
- Offshore patrol vessels and floating docks
- Ballistic protection to combat vehicles and battle tanks
- Coast Guard vessels and in the repair of naval ships
- In land defence battle tanks
- Motor casing of missiles
- Mine protected and combat vehicles • Military and civil vehicles
- Artillery guns

The revised “Defence Procurement Policy 2016” encourages “Make in India” and supports indigenous manufacturing of defence equipment and spares. Apart from saving foreign exchange for

the country, it is aimed to bring about self-sufficiency and self-reliance, as well as position the country as an exporter of defence goods.

With a total borderline of around 15,000 km being shared with other countries and with a continuous threat of infiltration and illegal immigration, border management has been on priority list of the Government. Individual Steel items has applications in border management like – fencing, high-mast lighting and making border outposts. This may be owing to the advantages which steel structures offer like easy and faster installation & maneuverability through difficult terrains.

CIVIL AVIATION

Government has big emphasis on connecting more and more Indian cities with air transportation facilities. Under UDAN scheme, government aims at providing affordable aviation by making do-

Steel has following applications in the field of civil aviation:

- Airport terminal buildings
- Aircraft hangers
- Cargo buildings
- Baggage handling system structure
- ATC tower structure
- Aero bridge structure

Advantages which steel offers in being used for civil aviation infrastructure are:

- Very large clear span framing can be easily made in steel which is prime concern functionally and aesthetically for airport application
- Faster in construction in comparison to other materials and less disturbance at site.
- Faster construction resulting in early occupancy & early return on investment
- 100-120 M clear span hanger for aircraft maintenance, storage and manufacturing areas using steel structures



Long Span Structure

mestic flight charges economically accessible for middle-class citizens of India. Government intends to increase India's 124 airports to 620, to cater to one billion trips a year. Newer Airports with all ancillary facilities are thus to be developed. The material is being promoted to play a big role in the development of the civil aviation infrastructure which would be required for these targets to be achieved.

- For large storage of cargos, vertical multi-storey steel buildings and retrieval system help in faster storage and delivery
- Steel can offer very high architectural flexibility in design and fabrication

RURAL ELECTRIFICATION

As a part of inclusive development, Government's focus has been on bringing

electrical power to rural and remote areas of the country. On 28th April, 2018, Hon'ble Prime Minister announced the achievement of the target of 100% rural electrification, which is a big milestone in the development story of our country. Going forward, as the country aspires to achieve 100% connectivity in the household sector to the grid power, steel can play a major role in developing the infrastructure and thus assisting in achieving the target.

The scope of steel usage is significant in the Rural Electrification for both transmission and distribution purposes:

- Transmission towers (EHT/VHT/UHT) where Galvanised steel may be used for construction. Towers may also

- Distribution poles to support medium and low voltage distribution lines
- Electric poles and lighting masts for lighting of highways and streets
- Lighting high masts for area lighting purpose
- Supporting channels, brackets, supporting cross bracings and clamps
- Fabricated steel accessories for different arrangements

FOOD PROCESSING AND DAIRY INDUSTRY

The food processing and dairy segments have emerged as key contributors to the Indian economy. This is in the form of increasing more storage spaces for reduction the scope of food insecurity. Here Scope of galvanized and stainless



be made with

- Structural Steel in Latticed form
 - Steel tubular Sections & monopoles
- Electrical steel (also known as lamination steel or silicon electrical steel), a special steel tailored to produce specific magnetic properties to minimise power losses, is used to make the laminated cores of transformers.
 - Galvanized fabricated steel structures including sub-station structures
 - Transmission poles to carry high voltage transmission lines

steel is increasing. This is because of growing global demands for food safety in terms of hygiene, increased life cycle cost of production, elevated consumer demand for better quality and sustainability. These include food containers, kitchen sinks, cutlery, silos, tanks, etc.

RENEWABLE ENERGY

Renewable Energy is the call of the hour. Some of the viable sources are wind and Solar. The structures which may be con-

structed to support the sources may be made of Steel. The material is a highly recyclable green material, is a natural partner while considering greener forms of energy.

Certain areas which may be consideration for utilization:

- For construction of towers (solar tower, wind tower) and other supporting structures- use of Galvanised steel
- Solar poles and lighting masts with mounted brackets for solar panels, for purposes of lighting of highways and streets, area lighting, security lighting, commercial lighting, industrial lighting, etc.
- Wind energy generation projects are inherently steel intensive— 140 tonnes of steel are required for the average wind turbine
- Wind towers, depending on the size, scale, location, application and generation capacity, different types of towers are preferred— prefabricated open steel lattice towers, tubular steel towers, steel-concrete hybrid towers, reinforcing steel towers, etc.
- Copper-clad steel (reliable, cost effective and solves grounding problems) and a variety of other composite steel alloys for wind turbines
- Galvanised fabricated steel structures
- Supporting channels, brackets, supporting cross bracings and clamps
- Fabricated steel accessories for different arrangements

SANITATION

Proper facility of sanitation in highways is often not found. This facility needs to be addressed. Here Steel Toilets can be used extensively along Highways, in Rural areas and cities at road junctions for effective sanitation drive. Such steel made toilets are faster and easier for installation, maintenance and relocation.

HOUSING FOR ALL

The Government project of PMAY-Urban and Rural has opened a new vista of



Solar Cell Supporting Structure

faster and better construction. Here also steel may be a major player with the proper use of lighter gauges.

Steel intensive houses can be installed with Light Gauge Steel Frames (LGSF) technologies that are faster and easier for installation. Apart from residential houses, Offices, Hospitals, Schools and other government buildings can also be constructed with this technology.

Individual Items Doors and Windows

Steel made doors and windows and also door frames may be promoted as part of green initiative. It also has the environmental side of initiating in saving trees also.

Other Efforts: A Paradigm shift is concept

The efforts in boosting consumption may also be done by trying to change the ideas and concepts in the collective fashion.

Efforts need to be taken in shifting the focus towards considering and identifying the demands of the consumers, their requirements and to align the same suitably. The concept of “Customer is King” may be refocused.

The customer is now more interested in the end product. So, in order to satisfy this demand a “one stop solution” may be considered. This may give a thrust and thus boost consumption. Probable methods by which consumption may increase may be

- innovation of Product- through use of light gauge, high performance (higher grades) galvanized and color coated steels,
- Offer One stop solution rather than individual products - Collaborative approach in association with main and allied service providers,
- Popularising newer effective technologies: eg, Composite solutions such as Steel-Concrete, Steel-Glass, Steel-Aluminium,
- Utilizing the present focus on sustain-

ability and resource efficiency,

- Providing post product Services through Innovations in Supply Chain
- Skilling the workforces.

BENEFITS OF STEEL USAGE

• Speed of Construction

The advantage of parallel activity: Structural steel framing systems allow for many activities going on simultaneously, thus reducing the critical time path and ensuring early completion of the project. This is a big advantage for a project provided the same be monetized suitably.

• Quality Control

The material itself is manufactured under controlled condition. So the quality of the end product is quite assured. Offsite (in fab shops) fabrication in controlled conditions along with quality steel from mills allows for total quality control of the steel-based project. Properties and behaviour of steel under load can be predicted with a high degree of certainty.

• Greater Strength, Lesser Weight Ratio



Steel has a higher strength to weight ratio than its competing counterparts like reinforced cement concrete (RCC). Thus, the dead weight of steel structures is relatively less. This property makes steel a very attractive structural material for high-rise buildings, long-span bridges and structures, structures located on soil with low bearing capacity and structures constructed in seismic prone areas.

• Suits Large Span

Steel is the major material for long-span structures. Long spanned structures on the whole may be the requirement for unobstructed column-free spaces. Structural steel frames optimize for space efficiency through the use of slender columns maximizing useable floor space, longer spans for open, column-free spaces and less floor-to-floor heights.

• Aesthetic Appeal

Architects praise the natural beauty of steel and are excited about exposing it in the design of their structures to emphasize grace, slenderness, strength and transparency of the frame. Nowadays, colourful and elegant profiles are available to support architects' imagination.

• Design Flexibility

From the simplest, functional structure to the complex, signature design structural steel can be readily used to accomplish the design intent of the architect and structural engineer. No other framing material comes close to structural steel in the ability to encourage freedom of expression and design creativity.

• Ease of Design

Structural steel remains the most desirable material for the structural engineer to design the project. Innovative design approaches supported by 3D modelling techniques and cost-saving measures are all possible with project design with structural steel. IS 800: 2007 (Specification for Structural Steel Designs) has been embraced by structural engineers as the standard reference guide for structural steel.

• Recyclability and Reusability

Structural steel is the most recycled material on our planet and can be reused after disassembly without further processing.

• Modifiable

Structural steel buildings can be strengthened / modified / repaired / retrofitted in the future for newer applications, loading conditions, vertical expansions and changes as required.

• Ready Availability

The steel industry has the domestic production capacity to meet the foreseeable demand from construction industry both in terms of quantity and range of products / sections.

ASPECT OF SUSTAINABILITY

• Dry Construction

Lighter, thinner and larger panels are fixed on steel-framed structures, which leads to buildings with high energy efficiency because of high-performance insulation materials.

The costs and time of demolishing buildings made of structural steel are much lower than traditional construction systems by virtue of the lightness of the steel framing construction and the dry assembly of building products. Steel does not have any disposal costs, rather scrap steel is a useful resource for downstream industries.

Steel is 100% recyclable

**** Steel is infinitely recyclable and world's most recycled material**

Steel is recycled without any loss of quality even after several recycling operations. This allows us to use it over and over again for the same application. On the contrary, the performance characteristics of most construction materials deteriorate after recycling, becoming at best a by-product. These characteristics make steel a true and real PERMANENT RESOURCE essential for a circular economic vision.

SOCIAL BENEFITS

As one of the pillars of sustainability, steel offers a few distinct advantages in terms of social benefits,

- Steel facilitates rapid construction, resulting in less disruption to the local community around the building site. There are fewer vehicle movements to site, very little on-site noise and zero waste

- Steel construction enables structures to be demounted and rebuilt without noisy and dusty demolition. That's beneficial to the local community and leaves behind no environmental legacy

- The steel industry requires skilled, settled workers. There is little need or desire for an itinerant workforce, and as such it provides more stable employment than in some other sectors

- The high strength of steel enables it to achieve long spans, creating bright, airy buildings that are a pleasure to live and work in. Steel structures don't degrade with age either, so they never look tired and outdated.



CHALLENGES

• Right Promotional Effort

The right way of promotion towards proper usage of steel has been undertaken in a piece mill basis without any constructive and collaborative approach. This seems to have worked upto a point when demand is high. However, this strategy needs a change and a consolidated effort and a collaborative approach may deliver a thrust in its usage. The efforts in highlighting the benefits technically, cost wise, quality wise needs to be explained in open forums for creating awareness and also inform the end users.

This has been felt from long back, but the issue remains unresolved

A constructive approach from all the stake holders with a focused agenda may help in the penetration or areas which is assumed to have sufficient space in using steel.

• Create interest in College Level for Learning design with Steel:

The connection of learning about steel starts from the college level. Efforts and

suitable ways and means are to be made to the concept of "Catch them young" so that the students get engaged with steel from the very beginning. Proper environment of learning on the subject may be thought of.

• Revising the syllabus in Engineering Colleges

The syllabus in the colleges may be revisited and if required reformed so that designing with steel may be properly addressed and the students find it easy and comfortable to grasp it. The interest on the subject may get generated and the students may then pursue their study in their professional field.

Life Cycle Cost Analysis (LCCA) -A concept needing consideration

This is a concept which needs to be addressed when ever the actual cost of a structure is estimated. The costs incurred in a defined life of a structure must be taken care off in structures which are for general utilization.

To explain it more

• When we try to establish cost effectiveness of our infrastructural projects

through competitive bidding (generally a two-step process: technical bid and commercial bid), we need to critically look into CAPEX and OPEX the life cycle of the utility / asset in totality (rather than in isolation) and optimize. Therefore, Life Cycle Cost Analysis (LCCA) is tool to determine the most cost-effective option among different competing alternatives to purchase / construct, own, operate, maintain and, finally, dispose-off an asset or utility, when each option is technically appropriate to be implemented.

• It also helps to envisage an effective capital planning prior to the actual cost incurred and improve the efficiency in the usage of time and resources. Stakeholder's confidence also improves as reduced uncertainty in cost planning can lead to better asset performance and decrease the disruption and risks to the business. Typically, LCCA takes into consideration total costs incurred during the life-cycle of the infrastructure: most cost-effective option to build, operate, maintain, modernize and decommission the asset.

• Why steel is better than RCC in LCCA ?

• Deterioration of Reinforced Cement Concrete (RCC) and Pre-Stressed Concrete (PSC) in bridges and structures is a natural phenomenon and has started exhibiting in large number of structures. Also RCC / PSC cannot be recycled after replacement / decommissioning. Hence environmentally RCC/ PSC are termed as cradle to grave.

• Whereas, steel due its recyclability is called as cradle to cradle.

CONCLUSION

As a whole the complete ecosystem of infrastructure and construction has high space of use of steel at places where steel is most suited and useful. The list of some of the areas and domains have already been spoken. The Challenges and its solutions are well within reach and may be undertaken with proper initiative in a collective fashion. Only then will the target of 300 MTPA production will see a rational use and consumption. The nation is optimistic and all stake holders look forward for achieving the same.