

Proceedings - Workshop on “Steel – for Sustainable Development”



Dr. Rajesh Kumar Singh, Senior Director at SPHERA Solutions APAC and Middle East delivered the Keynote Address on *Steel - for Sustainable Development*.

He explained that for Sustainability it was necessary that there be a holistic environment impact quantification tool supporting product strategy; the potential environmental impacts of a product throughout its life cycle which covers value chain i.e., upstream raw materials production, transport, manufacturing, downstream transport, use and disposal be studied. He added that Guidance on sustainable design, Benchmarks, and Targets and Roadmaps were also necessary. These he said would be applicable to Designers, Architects, Material Suppliers, Contractors, Builders, Developers, and Users. He went on to explain how to conduct LCA.

Some of the aspects that came out of the presentation are:

- Steel contributes to 7% of global CO₂ emissions, hence resource efficiency is very important for Life Cycle Assessment (LCA).
- Environmental Product Declarations (EPD) help in rating of buildings/ structures.
- Net Zero (Carbon Emission) commitment of construction sector by 2027 – Operational CO₂ Emissions and Embodied CO₂.
- An elaborate BOQ is required to be calculated in order to calculate the Carbon footprint of a structure.
- The Global Warming Potential for an RCC building is 900 whereas for a Steel Intensive building it is 800 kg CO₂eq/m². Cement and Steel contribute 42% and 28% respectively to the Global Warming Potential (kg CO₂eq/m²) in a structure
- The Global Warming Potential for an RCC Bridge is 950 whereas for a Composite Steel Girder Bridge it is 450 kg CO₂eq/m².

Dr. Rajesh Singh then talked of the Sustainability interventions that need to be incorporated. He advised that while Steel has a lot of advantages but there were a few disadvantages also. Hence, the details need to be truthfully communicated to customers to enable them to make informed decisions.



Mr. Girish Dravid, Director, Sterling Engineering Consultancy Services Pvt. Ltd. presented on *Steel Composite Technology in High-rises*, and cited the advantages of Composite Construction – particularly for large spans and high rises, and showed some of the structures that have been built.

He mentioned that the IS 11384: 2022 vis-à-vis the first edition of 1962 is a very elaborate standard brought out by the Bureau of Indian Standards. He explained the different types of shear connectors, profiled deck sheetings, encased and infilled columns.

Mr. Dravid then presented brief case studies a number of the major composite construction projects built over the past 4-5 decades in India and abroad. He also cited the advantages and disadvantages of using steel.

He showed the various studies which need to be done for deciding on the type of structure for a particular building – costs & time, system performance, head room availability, etc.

Mr. Dravid was also candid in sharing the experience gained on the projects and what all need to be taken care of. He cautioned about the stresses that develop in a structure during various erection conditions. They all need to be analysed, studied and duly incorporated in the designs. Although the condition is temporary but can govern the design.



Prof. Siddhartha Ghosh, Dean (Educational Outreach) at Indian Institute of Technology Bombay. He also manages the ‘Structural Safety, Risk and Reliability (SSRR) Lab’.

He dealt with *Steel Intensive Structures – Sustainability Aspect* based on research work being done at IIT Bombay.

The presentation revolved around the Three Pillars of Sustainability:

- Economic – Relating to cost
- Environment – relating to carbon emission
- Social – relating to user costs, life costs, injuries, casualties

Life Cycle Cost (LCC) comparison of buildings (50 years life period) – without seismic consideration.

Major contributor Operational cost-plus Initial cost

RCC – Rs. 39.81 Crores, Steel – Rs. 39.46 Crores

Hence, LCC is insignificant – operation costs are found to be similar – material costs are determinants.

LCC comparison of bridges

30 m span, 8.5 m width, 2 lanes, 2 ways in Maharashtra

Life of steel bridge 60 years; Life of PCC bridge 30 years; Discount rate 4.25%.

Option 1, 50 years life – Steel is 13.68% cheaper than PSC – Road user cost is the deciding factor

Option 2, 100 years life – Steel is 27.73% cheaper than PSC – Road user cost as well as reconstruction cost are the deciding factors.

Way Forward

- a. Indian Standard for Structural LCCA
- b. Archiving of Construction and Maintenance Data
- c. Software for calculating LCCA
- d. Guidebooks for Short Span Bridge Designs



Dr. K Saravanan, Senior Vice President, Eversendai Construction Pvt. Ltd.

He very lucidly explained the *Construction of Large Cantilever Steel Concrete Composite Structure*.

He presented a few cantilever steel structures in India and then moved on to present the details of a very interesting structure – a large cantilevered steel-concrete composite structure for an office building with 10 floors.

He explained the design principles, the logistics involved in the construction, how the crane access was provided; how the analyses that were done for each stage and the connection details that were developed.

Erection was very challenging – Dr. Saravanan explained how at many stages of the erection work, structural analysis was done in tandem with the erection methodologies and sequence.

All fabrication was done off-site; hence transportation logistics was also involved. He also elucidated how the structure and the deflections were continuously monitored during erection and de-propping and measurements recorded using Total Station. The result was a unique building cantilevered from the core.



Mr. Kantish V C, Head of Steelsoft Consulting Services India presented on *Cold Formed Steel Buildings*.

He informed that use of cold formed steel (CFS) members started in 1850s but absence of design standard and code made acceptance an issue. However, now it is being used in many countries including India. He then dealt with the manufacturing technology and the advantages of using CFS to cater to the large scale requirement for housing to meet the growth in the urban population. To meet those requirements, he elaborated on the level of usage and the construction technology involved for housing. Mr. Kantish moved on to the software availability for CFS. the future prospects of CFS in construction, including the use and availability of software for designing and manufacturing of all components. BIM and its AI would ensure that each member would have a unique tag. That would speed the construction process.

He then moved on to inform that IS 801 was under revision and would be more elaborate than the current issue. He also explained the structural behaviour of CFS members and how lateral forces would be catered for.



Dr. Harshavardhan Subbarao, Chairman & Managing Director of Construma Consultancy Pvt. Ltd., and Chairman, Consulting Engineers Association of India, Western Region Centre.

He presented at length on *Steel in Bridges – Various Aspects*, and also covered Sustainability aspects.

Whole Life Carbon Emission = Embodied Emission (Capital) + Operational Carbon Emission

Foundation and substructures are highly carbon intensive.

Embodied Carbon Emission = Carbon Emission pertaining to Product Stage + Construction Stage + Utility Stage + End of Life Stage + Beyond Life Stage.

EDPs conform to ISO 14044, EN 15804

LCC Database – Gabi database or Ecoinvent database



Mr. Terrence Busuttil, Director constructsteel the steel construction market development programme of the World Steel Association (worldsteel). His presentation/ talk was online. He explained about *constructsteel, WSA in Steel Construction Promotion* and focused on explaining the solution – the development and ecosystems to be adopted by the steel producers and the steel promotion

Institute like INSDAG in India.



Mr. Charles Simoes, Independent Expert, currently Adjunct Faculty at Sardar Patel College of Engineering, Mumbai for Master of Technology students in Structural Engineering and Construction Management. He explained the concept and need for *Reusability of Steel for Sustainability*.

He drew attention to the need for using resources more efficiently and reduce wastage and thus the carbon impact. He explained the waste hierarchy and went on to recycling and reuse in view of the end of life scenario of steel and concrete.

He explained how reuse of steel, as distinct from recycling, has greater advantages and where all it can be used. The structure needs to be designed for deconstruction and reuse, and, dealt with their key principles. For deconstruction, records have to be meticulously maintained.

He also discussed about business model, reclamation process, barriers and the future outlook.

Presentations by Sponsors

JSW Steel, SAIL and Tata BlueScope Steel –explained their product portfolios and capabilities plus the material quality all aiming towards sustainability using steel for construction.