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STEEL STRUCTURES & METAL BUILDINGS

STRUCTURAL STEEL CONSTRUCTION SUMMIT
a new era in steel construction

Celebrating
9th December STRUCTURAL STEEL DAY
MUMBAI

COMPOSITE
VERSATILE
SPEEDY
FLEXIBLE
STRENGTH
WEIGHT
DUCTILITY
SUSTAINABILITY
RETROFIT
RECYCLED
PREFABRICATED
TENSILE
WELDABILITY
UBIQUITOUS
DEMOUNTABILITY
UNIFORMITY
HOLLOW
MODERN
SPACIOUS
ENVIRONMENTFRIENDLY
LIGHTER

STEEL IS THE NAME OF THE GAME...

REVAMPING CONVENTIONS WITH CREATIVITY

***Architect Manish Gulati,** Principal, MOFA Studio feels that the kind of accuracy and precision required for the purposes of aesthetics, functionality and subsequently maintenance is only possible in steel with the increasing shortage of skilled labor for RCC works...*

Q What are the major advantages of using steel vis-à-vis conventional materials?

A Steel is a very versatile material and extremely liberating for designers to work with as opposed to conventional building materials. From being light weight, to giving column-less large span spaces, it is an age old material with very modern expressions and compatibility. The need for faster construction makes it a very relevant material, as the paybacks and turnaround period is much lesser than the project cycle of a conventional building material. It almost puts steel construction at par, if not lesser than, RCC construction. In times to come due to the factor of time vis-a-vis construction cost, it may go lower than RCC construction cost. Precision is a huge factor when dealing with steel as a material. The kind of accuracy and precision that is required for the purposes of aesthetics, functionality and subsequently maintenance is only possible in steel.

Q How structural steel can be innovatively used in construction to provide design aesthetics and at the same time offer economical solution?

A Although steel has many applications in architecture, design, buildings, the use of steel in exterior skins and large span roofs is unbeatable when it comes to aesthetics as well as economical solution.

Q What should be the strategy of industry in promoting structural steel construction in India?

A So far in India, structural steel has been manufactured as standard cold rolled sections which were based on conventional orthogonal grid system and primarily used in factory or sheds or infrastructure projects.

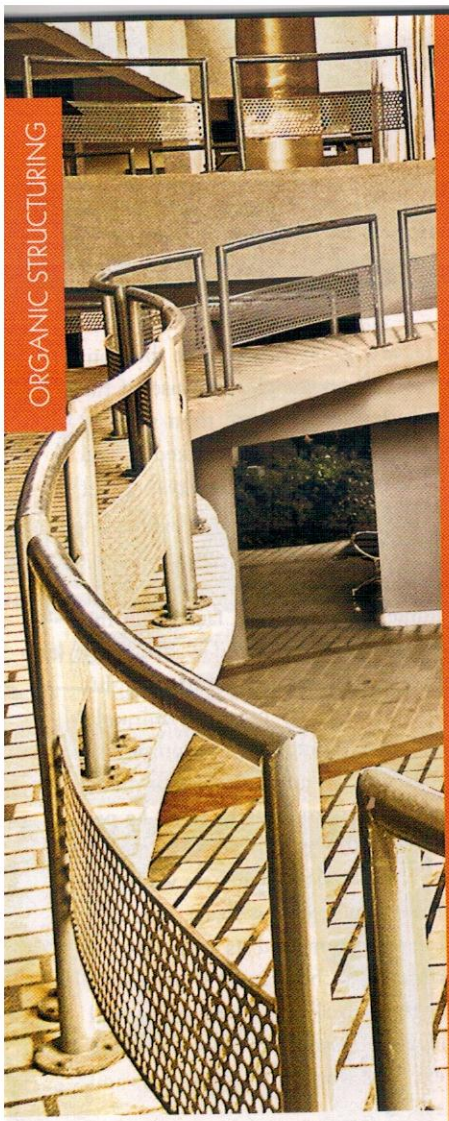
Today, steel is being used extensively by designers, albeit in more contemporary forms and aesthetics. There is a need of the hour for the Industry to work in close proximity with structural designers, architects and product designers to make customized sections which have a wider design appeal. As designs and digital fabrication are possible and its application is possible across architecture, product design and interior design industries apart from infrastructure stand to benefit.

Q What trend are we going to witness in the next 5-7 years, as far as designing structures with steel is concerned?

A Digital fabrication, which is based on parametric design i.e. a non-orthogonal or non-grid based design which is not a simple truss or a space frame structure, but wherein each dimensional change leads to change in the overall structure is what the future trend entails, e.g. a progressive shell. It is a process wherein from computer modeling, to analysis, to fabrication through CNC / Laser machines, is all computers controlled; leading to precision and advent of various shapes and forms being possible.

Q Which are the iconic steel-specific projects executed by you?

- Delhi Pollution Control Committee, New Delhi
- NIFT, Kangra, Himachal Pradesh
- NIWS, Goa
- Aerath Resort, Naggar
- ITM School of Business, Gwalior
- Forest Club, Noida



ITM SCHOOL OF BUSINESS, GWALIOR

a parametrically curved ramp and skewed steel canopy

The design response being an institutional building of a business school in a hot city like Gwalior was to build a structure which is both economical and green. The outside walls of the main building of the business school's campus reflect tradition sprinkled generously with doses of modernity. The use of locally-sourced white Dholpur sandstone for these external walls not only promotes and demonstrates a feather-light environmental footprint, but also keeps alive Gwalior's architectural heritage.

Climatically Gwalior has a sub-tropical climate with hot summers and humid monsoons, which is why the parasol roof, the jaalis and the strung courtyards along with its orientation make the architectural response to the elements very apt and green. Being an institutional project, budget and hence the choice of materials was important. This also led to ingenious detailing and adaptations. Since modern construction materials and techniques were not widely available, indigenous adaptations were worked out to integrate traditional building practices.

Structural Specifics

The design created by MOFA was complex in relation to generation of geometry for the structural systems due to parametric architectural designs. The challenge for the team at Roark Consulting Engineers was to resolve the complex architectural design into easily constructible structure.

The structure was a two-floor concrete SMRF framed structure with a steel canopy at the top. The foundation was isolated and combined footings. The frame was a special moment resisting RCC frame with ductile

Client
ITM University, Gwalior

Architect
MOFA Studios Pvt. Ltd.

detailing for the 2 RCC floors. Secondary beams were introduced to break the slab panels into smaller segments. The stability of the steel canopy was achieved through provision of stay braces in the transverse direction and wind bracings in the longitudinal direction. The design of a parametrically curved ramp and the skewed steel canopy makes for a salient feature of the project. Moreover, the mixed use of concrete and steel structures for a parametrically skewed architectural design with ample double height spaces has made the structural engineering for this project unique.

Green Design Aesthetics

Keeping high temperatures at bay and lowering air-conditioning costs is the building's parasol roof. Acting as the building's high volume, on slender columns, the roof provides a sense of relief to the inhabitants and makes the ITM School of Business a truly green building. Due to building's open center, the building's hot air rises to the top and collects there.

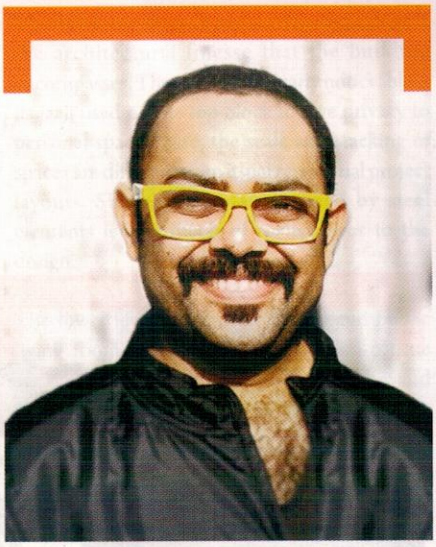
The open parasol roof allows the hot air to escape creating convection currents and a natural air-cooling system. Adding to this natural cooling system is the greenery in and around the building. The plants on the first level retain moisture, thus, helping keep the ground level's air mild and refreshing. The landscape planning around the building, the terrace gardens enabled with sustainable water retaining organic soil composition for the plants to thrive and bring down the ambient temperature in the classrooms.

Through the south western facade of the building, the blowing hot dry winds enter the building and get trapped in the thriving terrace garden creating a humidity-rich zone, and thereby, lowering the ambient temperature in the building. Roof gardens or terraces are built as intermediate open spaces throughout the building for shading and cleansing of the air quality and providing the much needed 'step out' for students.

The courtyard and the jaalis along with the roof make the air flow and ventilation in the building extremely airy and cool, reducing the AC requirement and load in a very harsh climate. The roof collects and takes the water to the rainwater recharge well.

Flowing Interior Layout

Behind the solid mass created by the traditional Dholpur clad walls lies a fluid interior space that flows in from one court of the building to the other. The free-flowing interiors of the building unleash fluidity of thought, imagination, ideas, and the self. The



ARCHITECT MANISH GULATI
Principal
MOFA Studios Pvt. Ltd.

The outside walls of the main building of the business school's campus reflect tradition sprinkled generously with doses of modernity. The use of locally-sourced white Dholpur sandstone for these external walls not only promotes and demonstrates a feather-light environmental footprint, but also keeps alive Gwalior's architectural heritage. Climatically Gwalior has a sub-tropical climate with hot summers and humid monsoons, which is why the parasol roof, the jaalis and the strung courtyards along with its orientation make the architectural response to the elements very apt and green. Being an institutional project, budget and hence the choice of materials was important. This also led to ingenious detailing and adaptations. Since modern construction materials and techniques were not widely available, indigenous adaptations were worked out to integrate traditional building practices

Structural Consultant	Contractor	Size	Status
Roark Consulting Engineers	**Kesar Constructions**	**40,000 sq. ft.**	**Completed**

ground level is built on the principles of the traditional Indian Courtyard and provides students with a large open space in the center that allows for introspection and the importance of knowing oneself, yet allowing for meaningful interactions that accentuate a feeling of openness and freedom.

The clean grey walls, the amoebic sculpturous water body, and modern landscape blobs on the floor reflect the entrepreneurial spirit of the students who are looking to create ripples within the otherwise structured business environs. The expansiveness that is showcased with large courtyards is mirrored on the first floor, which provides natural ventilation keeping the building sustainable and eco-friendly due to the minimized usage of artificial lights during the day. The fluidity of the ground level extends to the first with the help of an effusive, curvaceous modern ramp, with simple, evenly distributed steel railings.

Impressive Externally

The external façade is clad with the beautifully characterized and textured Dholpur sandstone. It sits thick and high, excluding out the harsh sun of Gwalior but with the help of jaalis and steel roof that creates openings, expansiveness and gets in plenty of light.

Light weight steel parasol roof was part pre-fabricated and the rest assembled on site and hoisted up. It clearly shows the steel trusses and offsets it against the rustic finished Dholpur sandstone walls. It emphasizes solid heavy walls clad with sandstone rising up to the new-age light steel structure.

Inspired by the traditional Jaali works of Gwalior, the building uses this element as modern screens on the south western side, which also happens to be the double height entrance space. The screens act as a vertical extension of the building's open courtyards. Standing tall at six metres and facing west, these screens cut the harsh Gwalior sun glare protecting the building, in the process creating those ever-changing patterns over the blank interior walls; reminding the users every day that nature paints the most exquisite landscape as long as we can provide a suitable medium to do so.

These white Dholpur sandstone screens are not just an aesthetic treat that cast interesting shadows and play with light, but also an architectural must for the high temperatures of Gwalior. The building keeps Gwalior's tradition of jaali work alive, reminding the students to embrace the new and advanced, while staying true to their self and tradition.

Green Features

- Starting with the orientation of the building, it harnesses both the north-western winds prevalent in Gwalior as well as adequate diffused daylight to naturally ventilate, cool as well as minimize the use of lights during the daytime. Also bolstering this is the smart lighting system.
- The parasol roof and window overhangs are deep .The depth of the overhangs and the roof is designed as per the sun direction and penetration so as to keep a balance between the availability of natural day light inside the office throughout the day yet not increasing the ambient temperature inside the building. This brings down the need for lighting significantly.
- Continuous Ramp along the courtyard connecting all levels makes it "disability-friendly" building.

Materials Employed

The material palette is as below:

- Gwalior White stone
- Dholpur stone cladding
- Light weight steel parasol roof: was part pre-fabricated and the rest assembled on site and hoisted up
- Jaali screens: Modular stone jaali screens strung together with concealed steel members to give it a contemporary application and language
- Double glazing integrated in locally assembled steel sections to reduce cost and increase durability
- Jaisalmer yellow and Terrazo flooring ■

PANKAJ GUPTA
Co-Founder & Partner
Roark Consulting Engineers

It is always a pleasure to work on MOFA projects due to their unique and challenging designs. Multiple alternatives and iterations of structural systems was required to achieve the architectural brief of form and function along with the structural integrity and robustness. Special provision for torsional forces is a must for each of MOFA projects including this one