

Skeleton Consultants



IIIT Nagpur, Maharashtra

IIIT are a group of institution of higher education in India offering high quality education, with modern technology and amenities with good infrastructure. IIIT Nagpur is based on the public-private partnership (PPP) model, funded by the central government, state government and industry partners and was approved by MHRD in 2015.

The project consists of four buildings listed below-

- Academic Block (G+5), Composite Rcc & Steel
- Administration Block (G+2), Composite Rcc & Steel
- Hostels (G+10), Rcc
- Type-3 Housing (G+11), Rcc

-Corridor connecting the Buildings
The project comprises of Steel-Concrete composite structure as well as RCC buildings. Academic & Administration blocks have structural Steel I-section encased with concrete as composite columns, RCC Shear wall, Composite steel Beams, and steel joists with GI deck sheet with RCC on top as floor. Hostel & Housing are conventional ductile framed structures with RCC columns, Shear wall, Beams & RCC slabs to suit the architectural brief.

Why Composite

Composite material for academic and administration block was the unanimous choice Because of the following reasons

- Concrete is efficient in compression and steel in tension
- Concrete encasement restrains steel against buckling.
- Steel Bring ductility into the structure.
- Composite Construction provides protection from fire and corrosion,

durability, high strength related to weight, and offers great degree of flexibility and sturdy behaviour.

- The decking provides a safe working platform. Labors need not depend on shuttering and its corresponding props for working.
- Compared to RCC construction, there is a significant reduction in dead load of the structure.

•Steel Concrete composite Beams

Composite beams were fabricated steel sections having yield strength of 450 MPa confirming to IS2062 that act compositely with the slab. The composite interaction is achieved by the attachment of shear connectors to the top flange of the beam.

The composite action of steel and concrete is utilized to optimize beam design. Composite design helps in reducing the size of section, controlling deflection and achieving economy.

Composite beams are similar to concrete T-Beams where the flange of the T-Beam is made of concrete slab and web of the T-beam is made of the steel section. The concrete act a large "flange" in compression, while a much greater portion of the steel beam acts in tension.



•Steel Concrete Composite Columns

A steel-concrete composite column is a compression member, comprising concrete encased plate fabricated steel section having yield strength of 450 MPa conforming to IS 2062.

In composite construction, the bare steel sections support the initial construction loads, including the weight of structure during construction. Concrete is later cast around the steel section.

Advantages of composite columns-

- Increased strength for a given cross sectional dimension.
- Increased stiffness, leading to reduced slenderness and increased buckling resistance.
- Good fire resistance and corrosion protection in the case of concrete encased columns.

The total design lateral forces are resisted by the Shear wall-beam frames and bracing in proportion to their lateral stiffness at all the floor levels. Hollow tubular sections are preferred for cross bracing due to slenderness benefits resulting from higher radius of gyration. Simple connections are considered for column-beam junction for stable behaviour.

Composite columns are analyzed as pinned base over the pedestal. This helps in optimization of foundation & substructure thus achieving economy. Through rigorous analysis



and design iterations, the structural stability was ensured while satisfying the budgetary constraints as well as time constraints.

Challenges

There were quite a few complexities involved while designing this project.

- The locations of bracing were carefully chosen to satisfy design requirement for lateral forces due to Wind & Earthquake and aesthetics & functional requirement of building.
- Since designing of composite structures is not vastly done across India therefore it was challenging to Design the structure. To overcome that many literature and papers from foreign authors were referred.

- Due to presence of steel girder, steel reinforcement within the column and presence of beams at beam-column junction, the connections of Beam to Rcc member becomes cumbersome. Therefore connections were carefully designed, detailed and very meticulously shown in the drawing to limit the difficulty and to minimize any error during erection.

FAST FACTS

Client: IIIT NAGPUR
 Architect: Design Associates INC, Noida
 Associate Architect: Renu Robin Design Studio GK-II, New Delhi
 Structural Consultant: Skeleton Consultants Pvt. Ltd.
 Turnkey Contractor: M/s Krishna Builders Delhi
 Structural Steel: Aprox 500T
 Reinforcement: Aprox 1500T
 Status: Ongoing
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