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**STEEL  
STRUCTURES  
& METAL  
BUILDINGS**

**SSMB.IN**  
nerve of steel construction...

**TURNING**

**DREAMS  
INTO  
REALITY**





# FACT FILE

Function: Residential  
Client: Jindal Group  
Architect: KGD Architecture  
Structural Consultant: Skeleton Consultant Pvt. Ltd.  
Steel Tonnage: 8,100 MT

# JSPL STAFF ACCOMMODATION, ANGUL

a classic case of speedy construction

COVER  
FEATURE





“ The architectural intent was to create a very vibrant, young, flexible space for the employees of JSPL. The use of steel and the speed floor concept really created a sleek looking building and interior space. ”

**NEJEEB KHAN**  
Managing Director, KGD Architecture



JSPL has setup an integrated steel and power plant at Angul, Odisha on approximately 4,000 acres of land, and to cater for the housing demand of their staff, guests, trainees, students, and workers around 300 acres of land is earmarked. The layout of residential area includes low and high-rise towers, villas with amenities including parks, play areas, schools, hospitals, shopping centres, clubs, and sports facilities. This project includes type F residential towers for staff and is to be built on 10.05 acres of land. It comprises of 9 blocks of G+11 floor having 8 nos 2BHK units per floor. The total built-up area per block is 1, 05,260 sqft and of the entire project is 8, 52,080 sqft.

#### Design Intent

The residential towers are envisaged to be built using structural steel sections for gravity and lateral force resisting superstructure system. The sub structure up to plinth shall be built in reinforced concrete. The superstructure consists of Steel column-beam frame and has been analyzed as rigid jointed multi story non-sway frames in accordance with stringent Indian standard (IS Codes) provisions and detailed intricately to take residential occupancy into account.

Cross bracings have been provided at locations not to hinder with the aesthetics and functionality of the

building and to resist the lateral loads due to wind and earthquake. Skeleton were the structural engineering consultant; to provide engineering design and technical assistance.

#### Structural Geometrics

Angul being a remote area, there was scarcity of skilled labour and traditional methods of construction were thus not feasible.

Various, alternative technologies were studied, and pre-engineered steel concept was adopted owing to the advantage of being an offsite and customizable method. The primary frame of the building comprises of ordinary moment resisting steel



Beam-Columns frame with cross bracings in vertical plane.

The floor system consists of 90mm concrete screed over the light weight Speed floor joists and will act as rigid diaphragms in horizontal direction. The Speed floor system is a unique suspended concrete flooring system using open webbed, roll formed, galvanized steel joists. Another unique aspect of the projects is use of Schnell wall panel which consists of a sheet of polystyrene sandwiched between two mats of welded wire mesh.

The total design lateral forces are resisted by the columns-beam frames and bracings 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. Moment resisting connections are considered for column-beam junction for rigid and stable behavior and being lighter. Steel columns are analyzed as pinned at top of RC pedestal and support reaction at that location were considered for substructure design in order to make the substructure lighter.

### Structural Uniqueness

The project has many unique features, some of which were used first time for a multi-story tower construction. The superstructure is designed in structural steel which offers flexibility and strength, in addition to light weight material. Under the action of earthquake forces, the structure is required to be flexible and low weight, as heavier structures attract larger forces when an earthquake occurs. Using structural steel, forces in the structure are reduced and its foundations are therefore lighter. This reduction of design forces significantly reduces the cost of both, the superstructure and foundations of a building.

### Speedfloor System

Speedfloor is a suspended concrete flooring system using a roll formed steel joist as an integral part of the final concrete and steel composite floor. The system has been developed combining modern techniques and roll forming technology for a fast, lightweight, concrete/steel composite floor at a cost-effective price.

The joist is manufactured from pre-galvanized high tensile steel in a one pass

roll former, where it is roll formed, punched, pressed and slotted to a high degree of accuracy at a fast production rate. The ends are simply bolted to the joist which are then ready for shipping to site. The Speedfloor System essentially is a hybrid concrete/ steel tee-beam in one direction and an integrated continuous one-way slab in the other direction.

The floor system comprises of Speedfloor joists. Speed floor joist is a unique concept where roll formed joist of 350MPa yield strength are used. The joist is manufactured from G 350 Z275 pre-galvanized steel. The roll formed shape with its pressed web produces a rigid and accurate steel section that has a high load carrying capacity and therefore good spanning characteristics with no propping requirements. The joist needs no shoring and is light enough to be manhandled into place, the services can be passed through the holes pre-punched in the joist. The joist utilizes the composite action with the concrete topping and thereby offers a fast, lightweight and cost-effective solution. The lockbars support the temporary plywood formwork between the joists during construction. They are spaced





“ Increasing demand of residential dwelling units in country and huge gap created due to speed of conventional construction technique has encouraged usage of RAPID MASS HOUSING through STEEL frame construction integrated with SPEEDFLOOR system and LGFS/other dry wall systems. Added advantage is assured quality of output building for enhanced durability and performance. SKELETON has developed expertise and competency in producing such buildings and structures contributing to growth of country. ”

**ABHAY GUPTA**  
Director, Skeleton Consultants Pvt Ltd



approximately 300mm apart and engage in the slotted holes punched in the top section of the joist. They also maintain the exact spacing of the joists.

High-density paper overlaid 12mm plywood is used as formwork to produce a first-class finish to the underside of the slab. The rigid plywood sheets are used in conjunction with the lockbars and when locked in place, provide lateral stability to the entire Speedfloor system during the construction phase. The wall system consists of a sheet of polystyrene sandwiched between two mats of welded wire mesh. The panels have excellent insulation properties, besides being light in weight, easy to handle, and convenient to transport to the remote areas. The wall panels have 35mm shotcreting on both side, which increases the strength of the wall.

#### Steel used

The growing number of multi-storey residential buildings being specified with steel frames clearly demonstrates

the ability of structural steelwork to comfortably meet all of these demanding requirements. With steel, the benefits of off-site manufacture can be seen, and felt, during construction and in use. The speed of steel construction can lead to earlier returns on investment and more predictable completion dates. On tight urban construction sites, where access and space for storage and materials handling are at a premium, steel deliveries can be timed to reduce traffic congestion and minimize storage requirements.

For Primary framing members, UC and UB sections manufactured by JSPL having yield strength of 345 MPa conforming to IS 2062 are used. Hollow tubular sections are considered for cross bracings having yield strength of 310 MPa.

Industrial plants were situated in distant locations and were not easily accessible. The success of every plant lies on its infrastructure development, facilities and build environment. JSPL coming up with a mega steel & power plant at Angul, Odisha, which

will produce 12.5 MTP steel and generate 2600 MW of power in phases. With the construction being in full swing, the need to complete the plant in scheduled time, tremendous manpower is required. To cater to their habitation, a massive housing demand is generated for their workers and staff. This was not feasible to achieve by traditional method of construction in such remote areas, where the scarcity of skilled labour persists. To achieve the housing demand, I was forced to explore new construction techniques to meet the housing requirements and this became an ambitious project for me. Various construction technologies were studied. The pre-engineered steel structure concept was adopted along with various other technologies for other elements. ■

