

Exploring Steel Consumption Trends in Commercial Buildings

(A consolidation of Case Studies)



Institute for Steel Development and Growth (INSDAG)

Our Mission Statement

To work in unison with all the stakeholders in the steel industry so as to evolve ways and means for more efficient usage of steel and provide optimum value to the customer.

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(A consolidation of Case Studies)

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Foreward for Exploring Steel Consumption Trends in Commercial Buildings (A consolidation of Case Studies)

I extend my commendation to the Institute for Steel Development and Growth (INSDAG) for its dedication in advocating the merits of structural steel in construction over the past two decades.

Because of challenges such as high initial costs, limited availability of diverse range of sections, and skill gaps in fabrication, the utilization of steel in construction projects across the India has not mirrored the upward trajectory that has been observed globally.

However, it is undeniable that steel continues to play a pivotal role in the development of our nation's infrastructure, particularly in bridges and buildings, owing to its unparalleled strength, durability, and versatility. For instance, Howrah Bridge in Kolkata stands as a testament to the steel industry's capabilities.

The decision-making process for builders and developers often involves weighing the advantages of reinforced concrete (RCC) against steel structures, with the cost implications at the forefront. Also there is a misconception and conflict of idea about the steel consumption per unit area among the stakeholders. In this context, INSDAG has undertaken a commendable initiative to compile case studies (43 Nos.) describing steel consumption per unit area in actual commercial buildings. This compilation serves as a guiding resource, offering insights to the stakeholders in construction sector.

Benchmarking steel consumption per unit area is an integral part to identify areas for enhancement of the steel usage. I extend my sincere appreciation to every member of INSDAG for completion of this project, which will be beneficial in offering insights for improvement of the strategies for augment of the steel consumption in INDIA.



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Director, Skeleton Consultants Pvt. Ltd.

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We express our heartfelt gratitude to the numerous individuals and organizations whose support and assistance have been instrumental in the realization of this project.

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We also extend our thanks to every member of INSDAG for their unwavering cooperation and encouragement throughout this endeavor. The support has been integral to bringing this project to fruition.

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Introduction:

India possesses immense potential to significantly boost its steel consumption, aligning itself with industrialized nations that prioritize steel in various development and infrastructure projects. The strength, durability, and adaptability of steel make it an invaluable asset for the nation's infrastructure and building initiatives.

Beyond its structural prowess, steel stands out as an eco-friendly construction material, outshining competitors in terms of sustainability. As one of the cornerstone materials in construction, steel's reliability and versatility are unrivalled. It plays a pivotal role in the construction of iconic structures, ranging from skyscrapers to bridges, forming the backbone of modern infrastructure.

Recognizing the critical importance of understanding steel consumption per square foot, architects, engineers, and builders must grasp this metric to estimate costs accurately and ensure the integrity of structures. In line with this imperative, the 51st Executive Council Meeting of INSDAG on 5th October 2023 underscored the necessity for a quantification study. This study aims to determine the steel consumption per square foot, offering valuable insights that can propel the promotion of steel-based construction, particularly in urban areas. By fostering a deeper understanding of steel's efficiency and benefits, this initiative seeks to accelerate India's journey towards embracing steel as a primary choice in its construction landscape.

Scope and Objectives of the Report:

This report serves as a consolidated repository of case studies, offering a nuanced exploration of design intricacies in real-world steel commercial buildings. It stands as a document encompassing multiple project details, with a primary emphasis on providing a tangible and accurate quantification of steel consumption per square foot for commercial steel structures.

The central objective of this report is to confirm or ascertain a potential usage in steel consumption, ultimately serving as a tool to monitor changes over time. This comprehensive study is a step towards assessing the steel consumption data of both completed and ongoing projects. The scope in the realm of the study can range from multiple paradigms such as:

- Data Collection
- Actual Site Conditions and its effect on steel consumption
- Determine the steel consumption patterns across various types of structures
- Recommendations for the stakeholders in the steel industry based on the patterns of consumption

The focus of this study is primarily on data collection and the initial analysis of steel consumption patterns in the commercial sector.

As we navigate through the intricacies of each case study, this report emerges as a valuable resource for professionals, architects, engineers, and decision-makers in the realm of commercial construction. It encapsulates the collective wisdom derived from real-world projects, offering a roadmap to enhance efficiency, sustainability, and the overall success of future endeavors in commercial steel building construction.

The main scope of this project can be encompassed in three parts

Identification of
Projects

Collecting all relevant
data related to the Project

Determining Steel
Consumption

Drawing Conclusions
based on the results

Collection of required Data Points:

The cornerstone of this project lies in the meticulous collection of datasets, which serve as the bedrock for ensuring accurate steel consumption. Field data collection in construction projects is a pivotal endeavor aimed at procuring precise information regarding the quantity, specifications, and utilization of steel materials.

The reliability of these datasets is paramount, and while there's no one-size-fits-all answer, certain characteristics are universally valued. Firstly, data points must be accurate and precise, reflecting the true essence of the phenomenon under study. They should also be representative of the statistical population, providing a comprehensive understanding of the subject matter. Moreover, to maintain integrity, data points should be devoid of bias, ensuring an impartial and objective analysis.

INSDAG has undertaken this study with a multifaceted approach, incorporating real field surveys, interviews, focus groups, and observations. Additionally, insights gleaned from previous professional award nominations and submissions have enriched the dataset. Not only do these sources furnish us with actual data, but they also offer invaluable contact details of the parties involved in the projects.

By amalgamating diverse data sources and employing rigorous methodologies, INSDAG has strived to ensure the integrity and reliability of the datasets. These efforts lay the groundwork for informed decision-making, fostering transparency, and advancing the discourse surrounding steel consumption in construction projects.

Factors Affecting Steel Consumption:

- **Structural Requirements:** The type and scale of the structure significantly impact steel consumption. Skyscrapers and large commercial buildings demand substantial steel to support their weight and resist wind loads. In contrast, smaller residential properties may require comparatively less steel.
- **Faster Construction:** Steel structures are typically fabricated off-site and then assembled on-site. The prefabrication process allows for quicker assembly, as standardized steel components can be mass-produced and easily transported to the construction site.

- **Design Complexity:** Architectural intricacies, such as curved facades, cantilevered sections, and irregular shapes, often necessitate additional steel reinforcement. These design elements enhance aesthetics but can escalate steel consumption per square foot.
- **Local Building Codes and Regulations:** Building codes dictate minimum requirements for structural integrity and safety. Some regions have stringent seismic or wind-load requirements, necessitating higher steel consumption to meet regulatory standards.
- **Construction Material Alternatives:** Advancements in construction materials, such as composite structures and reinforced concrete, offer alternatives to traditional steel frameworks. Depending on project specifications and budget constraints, builders may opt for materials other than steel, affecting consumption rates.

Significance of this study in Construction Projects:

Accurate estimation of steel consumption is indispensable for several reasons:

- **Budgeting and Cost Control:** Estimation of the steel consumption enables the stakeholders to take decisions on the choice of material and to formulate realistic budgets and allocate resources efficiently. It helps prevent cost overruns and ensures financial viability throughout the project lifecycle.
- **Structural Integrity and Safety:** Adequate steel reinforcement is paramount for maintaining structural integrity and safeguarding against structural failures, especially in high-rise buildings and infrastructure subjected to heavy loads or environmental stresses.
- **Compliance with Standards:** Adhering to building codes and industry standards is non-negotiable in construction. By accurately estimating steel consumption, builders can ensure compliance with regulatory requirements and mitigate legal risks.
- **Sustainability Considerations:** Optimizing steel consumption promotes sustainability by minimizing material waste and reducing environmental impact. Implementing efficient design practices and exploring alternative materials can further enhance sustainability efforts.

Project Details:

GMS Grande Palladium, Mumbai

The GMS Grande Palladium project takes a fresh approach to commercial design by embracing technology and intelligent design principles while prioritizing inclusivity and sustainability in urban landscapes.

One of the key features of the project is its innovative use of structural steel. The entire superstructure, including a 16.0m wide span central column grid, is constructed from steel. This choice offers flexibility in workspace design and allows for efficient transmission of loads through deflected structural shear skins, which help support cantilever loads. Internally, the structural steel elements are seamlessly integrated, with recessed internal membranes creating a visually harmonious space that blends form and function. By treating the structure as skin and integrating building volumes to serve multiple functions simultaneously, the project challenges conventional commercial design norms. It prioritizes substance over superficiality and innovation over conformity, symbolizing a paradigm shift in architectural discourse.

In summary, the GMS Grande Palladium project sets new standards for urban development in the subcontinent by pushing the boundaries of design and embracing a holistic approach to construction and sustainability.

- **Location:** Kalina, Mumbai
- **Owner:** GMS Group
- **Architects:** MALIK Architecture, Ballard Estate, Mumbai
- **Structural Consultants:** Structural Engineer – WSP UK
- **Structure Type:** Composite
- **Classification:** Office
- **Total Built-up area:** 180000 sq. ft
- **Total Steel Used:** 1600 Tonne

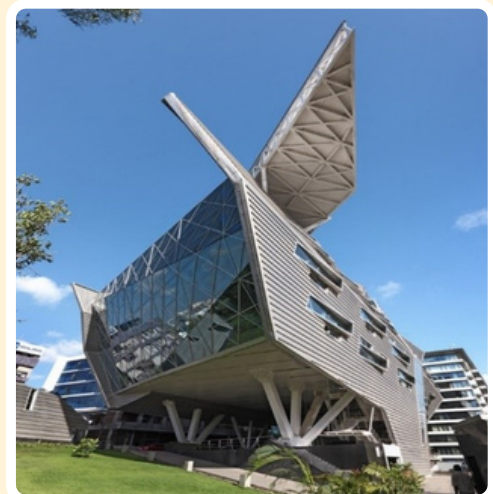


Fig 1: GMS Grande Palladium

Sattva Knowledge Park, Hyderabad

The Knowledge Park at Hi-Tech City, Hyderabad stands as a pinnacle of contemporary infrastructure, boasting state-of-the-art facilities and premium amenities. Utilizing the innovative slip form core construction method, this sprawling complex spans a total Built-Up Area (BUA) of 4.7 million square feet, comprising Towers A and B. Tower A, an impressive Tall Organic structure soaring to 105 meters, is complemented by Tower B, known as 'Sphereo-cube,' linked by the NH Hi-tech city road and the old Mumbai Highway. Situated strategically, this architectural marvel enjoys seamless connectivity to every corner of the city via a well-established public transportation network.

The distinctive design of the Twin Towers, overlooking both the Bio-diversity Park and Sattva Connect Park, enhances the productivity and well-being of occupants. Entrances and exits, thoughtfully positioned at the Ground, 1st, and 3rd floor levels, streamline traffic flow within and around the campus, optimizing accessibility. A majestic entrance adorned with lush landscaping and a serene water feature sets the tone for the entire campus ambiance.

Parking facilities, meticulously organized within the towers, feature separate entry and exit points, empowering tenants with autonomy and convenience. A dedicated Bus bay, located at the first-floor level, efficiently separates four-wheeler and two-wheeler traffic, facilitating smooth ingress and egress for employees as they journey to their office spaces.

- **Location:** Hyderabad
- **Owner:** Salarpuria Sattva Group
- **Architects:** RSP
- **Structural Consultants:** JSW Severfield Structures Ltd
- **Steelworks:** JSW Severfield Structures Ltd.
- **Structure Type:** Composite
- **Classification:** Office
- **Total Built-up area:** 47,00,000 sq. ft
- **Total Steel Used:** 20,000 Tonne



Fig 2 : Sattva Knowledge Park, Hyderabad

Indira Paryavaran Bhawan, New Delhi

Embarking on an ambitious initiative, the Ministry of Environment and Forests has set forth a visionary project for the Construction of a New Office Building at Aligunj, situated along the illustrious Jor Bagh Road in New Delhi. Entrusted to the capable hands of CPWD for construction, this project represents a paradigm shift towards sustainable architecture and environmental stewardship.

At its core, the design concept revolves around the aspiration of creating a net-zero energy green building a beacon of environmental sustainability and innovation. With the lofty goal of attaining LEED India Platinum Rating and GRIHA 5-star certification, this building stands poised to set new benchmarks in eco-conscious construction practices.

Integral to the design ethos is the strategic utilization of steel, leveraging its inherent strength, durability, and sustainability.

Steel components play a pivotal role in shaping the structural integrity of the building, facilitating innovative design solutions and enhancing its overall efficiency.

As the project unfolds, meticulous attention is paid to every aspect of construction, from material selection to energy-efficient systems and green technologies. The result is not merely a building but a testament to the Ministry's commitment to environmental responsibility and the pursuit of a sustainable future.

In essence, the Construction of the New Office Building at Aligunj represents a harmonious fusion of architectural ingenuity, environmental consciousness, and technological innovation. It serves as a shining example of how thoughtful design and strategic use of materials, particularly steel, can pave the way for a greener, more sustainable built environment.

- **Location:** Aligunj, Jorbagh, New Delhi
- **Owner:** CPWD, New Delhi under Ministry of Environment and Forests
- **Architects:** CPWD, New Delhi under Ministry of Environment and Forests
- **Structural Engineer:** INSDAG, India (For Composite Tower only)
- **Structure Type:** Part RCC and Part Steel- Concrete Composite
- **Classification:** Office
- **Total Built-up area of Composite Tower:** 31000 sq. ft (approx.)
- **Total Steel Used:** 684 Tonne



Fig 3 : Indira Paryavaran Bhawan, New Delhi

MFAR Building, Bengaluru

The MFAR project in Bengaluru stands as a testament to collaborative excellence, with MFAR Developers spearheading the initiative. Designed by RSP Architects and engineered by ABJK, India, the project showcases meticulous planning and execution. Gleeds, serving as the Project Management Consultant, ensures seamless coordination and adherence to timelines.

This architectural marvel boasts a complete steel-framed structure, employing innovative top-down construction techniques for the basement. The tower, comprising Basement + Ground + 7 Floors, offers a total built-up area of approximately 600,000 square feet. With a steel tonnage of around 2,800 MT, the project required extensive expertise in connection design, supply, and erection of structural steel, metal-decking, and fireproofing.

- **Location:** Bengaluru
- **Owner:** MFAR Developers
- **Architects:** RSP Architects
- **Structural Consultants:** ABJK, India
- **Structure Type:** Complete Steel Structure
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 600000 sq. ft
- **Total Steel Used:** 2,800 Tonne



Fig 4 : MFAR Building, Bengaluru

Globe Multiplex, Kolkata

The Globe Multiplex Project, led by M/s Dhansri Abasan Private Limited, represents a pioneering initiative in Eastern India. It introduces the region's first steel-concrete composite multiplex, showcasing innovation and architectural excellence. Spanning an impressive 65,000 square feet, the multiplex hosts around 80 shops, food courts, restaurants, retail chains, and 2 cinema halls.

The project's comprehensive master plan, architectural design, and interior layout were meticulously crafted by the esteemed M/s. Espace Architects from Kolkata.

Central to The Globe Multiplex's structural integrity and spacious design is the innovative use of structural steel. Steel elements play a crucial role in supporting the expansive layout and facilitating flexible spaces within the multiplex. This integration of steel ensures durability, strength, and adaptability to diverse functional needs.

In essence, The Globe Multiplex redefines entertainment and retail spaces in Eastern India, setting a new standard for architectural ingenuity and functionality in multiplex construction.

- **Location:** 7E Lindsay Street, Opposite New Market, Kolkata – 700016
- **Owner:** Dhansri Abasan Private Limited
- **Architect:** ESCAPE Architects, Kolkata
- **Structural Engineer:** Basu Consulting Engineers
- **Structure Type:** Composite
- **Classification:** Retail
- **Total Built-up area:** 65,000 sq. ft
- **Total Steel Used:** 365 Tonne



Fig 5 : Globe Multiplex, Kolkata

NetApp, Bengaluru

The NetApp project, a collaboration between NetApp as the client and Surbana Jurong as the structural engineer, showcases meticulous planning and engineering expertise. TRC + JSSL, the main contractors, spearheaded the construction process.

This monumental endeavor encompasses steel works spanning 1.4 million square feet, featuring 13 levels of a complete steel-framed structure extending from the basement. Remarkably, the structure was erected on-site within a swift 44-week timeframe.

Designed with brace frames, this architectural feat boasts a weight of approximately 7,000 metric tons. The project's successful completion underscores the synergy between innovative design, structural engineering, and efficient construction management.

- **Location:** Bengaluru
- **Owner:** NetApp
- **Structural Consultants:** Surbana Jurong
- **Structure Type:** Complete Steel Structure
- **Classification:** Office
- **Steelworks:** JSW Severfield Structures Ltd.
- **Total Built-up area:** 14,00,000 sq. ft
- **Total Steel Used:** 7,000 Tonne



Fig 6 : NetApp, Bengaluru

Ispat Pragati Bhawan

Located in Anandapur, Kolkata, the pioneering steel building erected by INSDAG marks a significant milestone in the city's architectural landscape. Standing four stories tall, this innovative structure serves as a beacon of inspiration for entrepreneurs, developers, consultants, and professionals, advocating the adoption of steel-based construction methods.

Distinguished by its modern design and forward-thinking approach, the building seamlessly integrates steel elements with glass encasements, offering a transparent view of the cutting-edge technologies employed in its construction. It serves as a living testament to the versatility and durability of steel, encouraging a shift towards sustainable building practices.

Embracing the principles of green building technology, the structure incorporates various eco-friendly features aimed at minimizing environmental impact and promoting energy efficiency. From its efficient use of resources to its emphasis on renewable energy solutions, every aspect of the building reflects a commitment to sustainability and responsible development.

As a symbol of innovation and progress, the Landmark Steel Building stands as a testament to the transformative potential of steel in the construction industry. Its visionary design and eco-conscious approach serve as a model for future projects, inspiring a new era of sustainable urban development in Kolkata and beyond.

- **Location:** Ispat Pragati Bhawan, Anandapur, Kolkata
- **Owner:** INSDAG
- **Architect:** Ar Nitin Kilawala of M/S Group Seven Architect, Mumbai.
- **Structural Engineer:** INSDAG
- **Structure Type:** Composite
- **Purpose of the Building:** Office
- **Total Built-up area:** 30,000 sq. ft
- **Total Steel Used:** 573 Tonne



Fig 7 : Ispat Pragati Bhawan, Kolkata

Reliance JIO HQ, Navi Mumbai

This ambitious endeavor comprised four buildings with varying heights of G+10, G+9, and G+7, forming a grand total of 1.2 million square feet of framed structure extending from basements. Impressively, the construction was completed on-site within a mere 48-week period.

A total steel frame structure by incorporating RCC core wall design, the project underscoring the meticulous planning and execution involved. This successful collaboration underscores the seamless integration of architectural vision, structural engineering prowess, and construction efficiency.

- **Location:** Navi Mumbai
- **Owner:** Reliance Industries Ltd
- **Architects:** SPCPL
- **Structural Consultants:** Ramboll + JSSSL
- **Structure Type:** Complete Steel Structure
- **Classification:** Office
- **Steelworks:** JSW Severfield Structures Ltd.
- **Total Built-up area:** 12,00,000 sq. ft
- **Total Steel Used:** 6,000 Tonne



Fig 8 : Reliance JIO HQ, Navi Mumbai

MSTC Head Office, Kolkata

With a keen focus on sustainable practices and cost-effective construction, the corporate edifice of MSTC stands as a prime example of innovation in the architectural landscape. Embracing steel as its primary structural component while minimizing concrete usage, the building epitomizes efficiency and environmental consciousness.

At the heart of this architectural marvel lies an Intelligent Building Management System (IBMS), seamlessly integrating various services such as security surveillance, air-conditioning, internal lighting, elevators, fire-fighting, and fire detection. This holistic approach ensures optimal functionality and safety while enhancing operational efficiency.

Harnessing the power of renewable energy, the rooftop of the building hosts solar panels boasting a capacity of 20 KW. The electricity generated powers internal operations, supplementing grid consumption and significantly reducing environmental footprint. Additionally, the widespread implementation of LED lighting further minimizes energy consumption, contributing to sustainable operations.

Recognizing the importance of water conservation, the building incorporates a comprehensive Rainwater Harvesting System, emphasizing responsible resource management and environmental stewardship. In essence, the corporate building of MSTC serves as a beacon of sustainable construction practices, embodying a commitment to environmental integrity and operational excellence in every facet of its design and functionality.

- **Location:** MSTC HO, Kolkata
- **Owner:** MSTC
- **Architect:** Srijan Architects, Delhi
- **Structural Consultant:** NBCC
- **Structure Type:** Composite
- **Purpose of the Building:** Office
- **Total Built-up area:** 59,000 sq. ft
- **Total Steel Used:** 769 Tonne



Fig 9 : MSTC Head Office, Kolkata

Prestige Trade Tower, Bengaluru

Prestige Trade Tower stands as a testament to efficient and practical design, boasting a refined and sophisticated architectural style. The building's emphasis on functionality is evident in its rectangular layout, strategically incorporating both service and traffic areas at its core. Situated in the bustling financial district of Bangalore, this towering structure rises to a height of 115 meters, further enhanced by the inclusion of a heliport, catering to diverse transportation needs.

- **Location:** Bengaluru
- **Owner:** Prestige Group
- **Architects:** RSP India
- **Structural Consultants:** Mahimutra Consultants Pvt Ltd
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 48,000 sq. ft
- **Total Steel Used:** 2,200 Tonne



Fig 10 : Prestige Trade Tower, Bengaluru

EON Free Zone, Pune

EON Free Zone project, situated in the Special Economic Zone of Kharadi, Pune, comprises of an IT park having four Pods (buildings). Each Pod is horseshoe shaped in plan, and the four of them are so arranged that an impression of a petal cluster evolves. The structural steel system for the roof consists of purlins supported on radially oriented trusses or beams. The radial trusses support the purlins at the peripheral area of the roof, wherein it cantilevers upto a maximum of 7m from the building line, while similarly oriented beams support the purlins in the interior spans. These trusses and beams have a curved top profile that follows the desired curvature of the roof surface. They are supported on main steel beams that rest upon the grid columns of the flat slab floors. The typical column grids of approximately 8.5m x 8.5m are used as they are ideal and economical for PT flat slab structure as well as for the office space layout. All steelwork involved normally available rolled steel beams, channels and angles, and box sections. All erections were carried out using normal derricks mounted on the floor slab. The steelwork is given a spray-type coating for fire proofing.

- **Location:** Kharadi, Pune, Maharashtra
- **Owner:** EON Kharadi Infrastructures Pvt Ltd., Panchshil Realty
- **Architects:** Nitin Parulekar Architects Pvt Ltd
- **Structural Consultants:** Shirish Patel & Associates Consultants Private Limited
- **Steel Contractor:** Petron Civil Engineering Pvt. Ltd.
- **Structure Type:** Roof Steel Structure
- **Classification:** Long Span Building
- **Total Built-up area:** 166840 sq. ft
- **Total Steel used:** 800 Tonne



Fig 11 : EON Free Zone, Pune

Phoenix Aquila Tower A & B, Hyderabad

Phoenix Aquila is a new office project by the Phoenix Group in Hyderabad. It is located at West Zone in Hyderabad. Phoenix Aquila is a twin tower project. With CWC overseeing project management and Shapoorji Pallonji Co. & Ltd along with Leighton India as the main contractors, this endeavor is marked by excellence in execution. SW Severfield Structures Ltd contributed to the steelworks, which encompass Tower B spanning 1.2 million square feet with approximately 4,000 metric tons of structural steel completed. Tower A, covering 1.8 million square feet, required about 5,500 metric tons of structural steel. JSSL's responsibilities included connection design, supply, and fabrication of steelworks and metal decking, ensuring meticulous attention to detail throughout the project.

- **Location:** Hyderabad
- **Owner:** Phoenix Group
- **Architects:** RSP
- **Structural Consultants:** Mahimtura Consultants & Consultants
- **PMC:** CWC
- **Main Contractor:** Shapoorji Pallonji Co. & Ltd & Leighton India
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 30,000,000 sq. ft
- **Total Steel Used:** 9500 Tonne



Fig 12 : Phoenix Aquila Tower A & B, Hyderabad

ICICI Regional HQ, Hyderabad

This large office complex has been recently completed in the IT hub of Gachibowli in Hyderabad for ICICI Bank. The plot is 300 m long and 80 m wide. A typical floor plate is 260 m x 64 m making it one of the largest office spaces in India today. It accommodates 22,000 employees in one shift at a luxuriously large ratio of area to a person compared to normal international standards. This when built back in 2011 was the largest single office building owned and used by a single owner for activities for a single business field in India and the 18 largest building in the world in terms of floor area available in one single building

Architectural Highlights:

There are three full basements and partial fourth one, above which there are four podium levels and then twelve typical office floors in this building. Architectural highlights of this building include a six-floor high atrium in the entrance lobby and large sloping garden stretching from end to end of the plot, rising from the second basement level at one end to the ground level at the other, supported on the sub-structure enhances the experience while entering the premises.

Structural Highlights:

In the times of economic surge and rapid growth in Financial and IT sector in India, ICICI Bank set a goal for the building to be completed in just 18 months which became a basis for the building be built as a composite structure. The super structure above ground was planned in structural steel columns, beams and deck sheets, while the sub-structure and four podium slabs were planned to be in Post-Tensioned and Reinforced Concrete. The impressive atrium in the entrance lobby is almost six floors high. This high-volume space is created by using 30 m spanning transfer trusses which in turn carry the load of the upper 12 floors. There are other transfer mechanisms in the building, especially in the auditoria and in the hotel section, where large column free spans were needed and the column grids changed due to hotel room configurations. These transfers of columns came into effect with fabricated plate girders spanning 10 to 30 m.

- **Location:** Gachbowli, Hyderabad, Telangana
- **Owner:** ICICI Bank Ltd.
- **Architects:** Architect Hafeez Contractor
- **Structural Consultants:** Sterling Engineering Consultancy Services Pvt.Ltd
- **Contractor:** Larsen & Toubro Ltd
- **Structure Type:** Composite Structure
- **Classification:** Office
- **Total Built-up area:** 4305564 sq. ft
- **Total Steel used:** 25000 Tonne



Fig 13 : ICICI Regional HQ, Hyderabad

Phoenix Centaurus, Hyderabad

Phoenix Centaurus, a project led by the Phoenix Group and designed by RSP, epitomizes innovation and excellence in architectural design. With a total area of 2.2 million square feet and approximately 10,500 metric tons of structural steel, Phoenix Centaurus stands as a symbol of modernity and efficiency.

- **Location:** Hyderabad
- **Owner:** Phoenix Group
- **Architects:** RSP
- **Structural Consultants:** Innotech Consultants
- **PMC:** CWC
- **Main Contractor:** Shapoorji Pallonji Co. & Ltd
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 2,20,000 sq. ft
- **Total Steel Used:** 10,500 Tonne



Fig 14 : Phoenix Centaurus, Hyderabad

Phoenix Business Hub, Hyderabad

Phoenix Business Hub, a visionary project poised to become a hallmark of the future, spans across an expansive 17 acres, positioning itself as the largest forthcoming privately owned Special Economic Zone (SEZ) campus nestled in the bustling financial district. This ambitious development will feature six towering buildings, each offering unparalleled vistas of the cityscape, promising an exceptional environment for commerce and innovation.

- **Location:** Hyderabad
- **Owner:** Phoenix Group
- **Architects:** Chapman Taylor Architects
- **Structural Consultants:** Strudcom Consultants
- **Main Contractor:** Shapoorji Pallonji Co. & Ltd
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** Tower 1: 1,00,000 sq. ft
Tower 2: 2,20,000 sq. ft
- **Total Steel Used:** Tower 1: 7,000 Tonne
Tower 2: 2,20,000 Tonne



Fig 16 : Phoenix Business Hub, Hyderabad

Phoenix H10, Hyderabad

The sprawling H-10 campus, extending over 14 acres, represents a significant expansion of our renowned Avance Business Hub. This meticulously planned campus is dedicated to serving as a premier IT/ITes Special Economic Zone (SEZ) office space, strategically positioned in the vibrant heart of Hitech City.

- **Location:** Hyderabad
- **Owner:** Phoenix Group
- **Architects:** Chapman Taylor Architects
- **Structural Consultants:** Strudcom Consultants
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 20,00,000 sq. ft
- **Total Steel Used:** 10,500 Tonne



Fig 17 : Phoenix H10, Hyderabad

Phoenix 285FD Tower-2, Hyderabad

285 Financial District, an expansive SEZ Campus, sprawls over 23 acres of prime real estate. This ambitious project is envisioned to command the skyline with its majestic presence. Boasting convenient access to the Outer Ring Road (ORR), as well as nearby residential, hospitality, and commercial amenities, it promises to be a strategic hub for business and innovation.

- **Location:** Hyderabad
- **Owner:** Phoenix Group
- **Architects:** Chapman Taylor Architects
- **Structural Consultants:** Strudcom Consultants
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 10,00,000 sq. ft
- **Total Steel Used:** 5000 Tonne



Fig 18 : Phoenix 285FD Tower-2, Hyderabad

Phoenix Equinox T1, T2, T3 & T4 Hyderabad

Spanning across 2.6 hectares, the development encompasses the construction of four commercial office towers, comprising two towering 20-storey structures and two more modest 11-storey buildings, all sharing three common basements.

Location: Hyderabad

Owner: Phoenix Group

Architects: Chapman Taylor Architects

Structural Consultants: Strudcom Consultants

Structure Type: Composite

Steelworks: JSW Severfield Structures Ltd.

Classification: Office

- **Total Built-up area:** Tower 1 & 2: 26,00,000 sq. ft
Tower 3 & 4: 8,00,000 sq. ft
- **Total Steel Used:** Tower 1 & 2: 15,500 Tonne
Tower 3 & 4: 3,100 Tonne



Fig 19 : Phoenix Equinox T1, T2, T3 & T4 Hyderabad

Phoenix P14, Hyderabad

Phoenix 14 stands as an imminent Campus SEZ and Non-SEZ, strategically situated in the heart of Gachibowli, Hyderabad. This expansive multi-tower campus occupies a prime location, offering seamless connectivity to transport hubs, dining options, shopping malls, and residential neighborhoods. Nestled amidst renowned establishments such as IKEA and Deloitte, it also commands a stunning view of the under-construction Phoenix H-10 campus. Occupants of Phoenix 14 are privileged with an array of amenities, including a vibrant food court, a well-equipped clubhouse, and a state-of-the-art sports arena, enriching their work-life experience.

- **Location:** Hyderabad
- **Owner:** Phoenix Group
- **Architects:** Chapman Taylor Architects
- **Structural Consultants:** Strudcom Consultants
- **MEP Consultant:** Design Tree
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 24,00,000 sq. ft
- **Total Steel Used:** 12300 Tonne

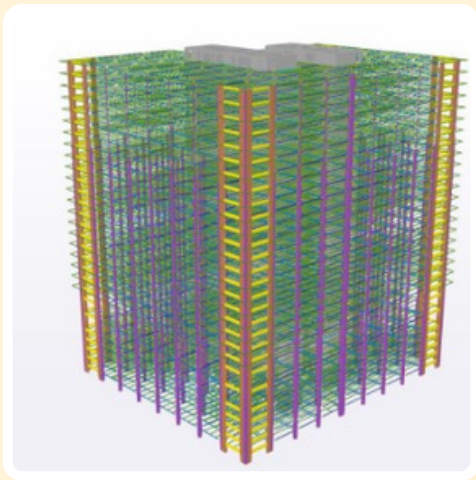


Fig 20 : Phoenix P14, Hyderabad

Phoenix P-25, Hyderabad

Located in Nanakramguda, P-25 by Phoenix emerges as a premier commercial endeavor boasting cutting-edge infrastructure tailored to empower businesses to reach their zenith. Positioned as a landmark project within the Extended IT Corridor, it has been meticulously crafted to foster mental wellness and physical well-being among its workforce, thereby enhancing productivity and overall satisfaction.

- **Location:** Hyderabad
- **Owner:** Phoenix Group
- **Architects:** Chapman Taylor Architects
- **Structural Consultants:** Strudcom Consultants
- **MEP Consultant:** Design Tree
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Office
- **Total Built-up area:** 24,00,000 sq. ft
- **Total Steel Used:** 11,800 Tonne



Fig 21 : Phoenix P-25, Hyderabad

Colt Data Centre, Navi Mumbai

Colt Mumbai Data Centre, an upcoming state-of-the-art facility fueled by an impressive 120MW of IT power, strategically positioned in the bustling locale of Navi Mumbai, it offers unparalleled accessibility to the city's major transportation hubs, including the Chhatrapati Shivaji Maharaj International Airport, Airoli Railway Station, and the soon-to-be-completed Digha Railway Station. Conveniently linked via the Thane-Belapur Road, this site holds pivotal significance in the expansion of data center infrastructure. Boasting access to robust power utilities and a dense network of fiber routes, it emerges as a prime destination for businesses seeking reliability and connectivity in their data operations.

- **Location:** Navi Mumbai
- **Owner:** Colt Technologies
- **Structural Consultants:** D&B by JSSL
- **Main Contractor:** Sterling & Wilson
- **Structure Type:** Complete Steel Structure
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Data Centre
- **Total Built-up area:** 6,00,000 sq. ft
- **Total Steel Used:** 3,500 Tonne



Fig 22 : Colt Data Centre, Navi Mumbai

AdaniConneX Centre, Chennai

The cutting-edge hyperscale data center campus nestled within the SIPCOT IT Park in Chennai, India, is pioneered by AdaniConneX, a joint venture between Adani Enterprises and EdgeConneX. In its initial phase, a formidable 17 MW (IT Load) is presented by the campus, poised to be elevated to a commanding 33 MW (IT Load) upon reaching full capacity.

Distinguished as Tamil Nadu's premier pre-certified IGBC Platinum Rated data center, 'Chennai 1' is characterized by sustainability, with up to 100% renewable energy sources being harnessed. This commitment to eco-conscious practices empowers enterprises and hyperscale clients with environmentally responsible energy alternatives.

Positioned as a beacon of technological advancement in the region, 'Chennai 1' sets a new standard in colocation excellence. Its robust infrastructure is fortified by seven layers of security, ensuring unparalleled protection for IT assets. Additionally, an unwavering dedication to maintaining 99.999% availability is pledged by the campus, assuring clients of uninterrupted operational continuity and reliability.

- **Location:** Chennai
- **Owner:** Adani Group
- **Structural Consultants:** AECOM
- **Main Contractor:** L&W
- **Structure Type:** Complete Steel Structure
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Data Center
- **Total Built-up area:** 5,00,000 sq. ft
- **Total Steel Used:** 4,000 Tonne



Fig 23 : AdaniConneX Centre, Chennai

Gaur World Street Mall, Ghaziabad

Gaur World Street Mall, a commercial project launched by the Gaur Group, offers a variety of retail shops, office spaces, and other commercial units. Situated in Sector 1B, Noida Extension, the project is designed to cater to the refined tastes of the upper crest with its intricate designs and refined craftsmanship, ensuring a sense of finesse.

Spread across 4.9 acres of land, Gaur World Street Mall features a dedicated zone for retail outlets, cinemas, a food court, multipurpose hall, offices, and studio shops. Its strategic location ensures excellent connectivity to NH24 and the residential societies of Gaur City, enhancing accessibility for both customers and businesses alike.

- **Location:** Ghaziabad
- **Owner:** Gaursons
- **Architects:** Atwin Architects
- **Structural Consultants:** VMS Consultants
- **Main Contractor:** Gaurson's In-house
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Commercial
- **Total Built-up area:** 9,00,000 sq. ft
- **Total Steel Used:** 7,500 Tonne



Fig 24 : Gaur World Street Mall, Ghaziabad

IKEA, Bengaluru

IKEA is renowned as everyone's favourite international furniture mart in India. Spread over 12 acres, the store in Bengaluru spans 5,50,000 sq. ft., featuring approximately 7,000 well-designed furnishing products. Additionally, there is a huge parking space accommodating approximately 1500 cars. Nagasandra is recognized as an excellent locality and prominent residential area, well connected to other major tech hubs via the service road and Asian Highway 47. Surrounding neighborhoods such as Peenya, Ancephalya, and Tippenahalli have seen significant development due to various economic activities.

- **Location:** Bengaluru
- **Owner:** IKEA
- **Architects:** Atkins
- **Structural Consultants:** Atkins
- **PMC:** Faithful+Gould
- **Main Contractor:** Shapoorji Pallonji Co. & Ltd
- **Structure Type:** Complete Steel Structure
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Commercial
- **Total Built-up area:** 5,50,000 sq. ft
- **Total Steel Used:** 4,500 Tonne



Fig 25 : IKEA, Bengaluru

Earth Enclave, Mumbai

Earth Enclave, located in Mumbai, is a composite steel project comprising ground plus one commercial floors, along with six floors dedicated to parking, and two residential towers. The first tower rises up to 25 floors while the second tower stands at 13 floors. These towers offer apartments ranging from 1 BHK to 4 BHK, catering to a diverse range of housing needs.

- **Location:** Mumbai
- **Owner:** Earth Developers
- **Architects:** Access Architects
- **Structural Consultants:** Thornton Tomasetti
- **PMC:** MACE, India
- **Main Contractor:** Quantum Constructions
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Residential
- **Total Built-up area:** 5,00,000 sq. ft
- **Total Steel Used:** 2,150 Tonne

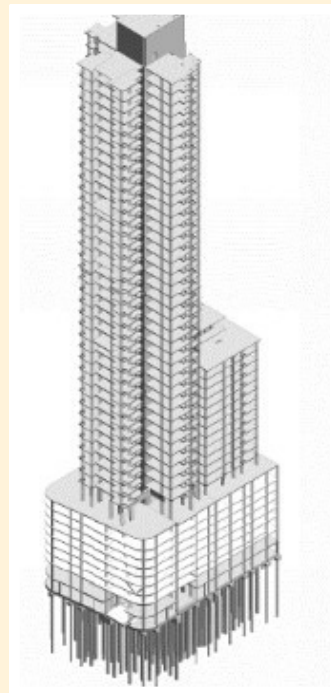


Fig 26 :Earth Enclave, Mumbai

M. Pandit Madan Mohan Malviya Cancer Centre, Varanasi

Completed in a record time of 10 months, the Mahamana Pandit Madan Mohan Malviya Cancer Centre, a vital component of Tata Trusts' expansive Cancer Care Program, now stands equipped with a capacity of 340 beds. This oncology hospital is positioned to cater to the entire populace of Uttar Pradesh and regions of Northern India, aligning with the program's mission to provide accessible and affordable cancer care nationwide while upholding the highest standards of quality.

Edifice Consultants' distinctive approach to healthcare architecture underscores the creation of healing environments deeply rooted in local aesthetics and cultural traditions. This ethos is reflected in the design of the hospital, which incorporates elements such as a flexible and future-ready base build strategy, cost efficiency through the use of steel structures, and LEAN design principles aimed at optimizing daily operations.

Drawing inspiration from Varanasi's iconic Ghats along the River Ganges and the prevalent use of the color red in the city's skyline, the hospital's design pays homage to these cultural landmarks. The terraced configuration of the building mirrors the stepped terraces of the Ghats, while the strategic placement of architraves and cupolas enhances its vertical profile. The extensive utilization of exposed red brick further enhances the building's contextual appeal, infusing it with a distinctive local character. Ultimately, the hospital's design seamlessly integrates with its surroundings, echoing the rich cultural heritage of Varanasi.

- **Location:** Varanasi
- **Owner:** Tata Trusts
- **Architects:** EDIFICE
- **Structural Consultants:** Dr.Kelkar Design Pvt. Ltd & JSSL
- **Main Contractor:** Capacite Infra. Ltd.
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Hospital
- **Steel Works :** 5,80,000 sq. ft
- **Total Steel Used:** 3,000 Tonne



Fig 27 : M. Pandit Madan Mohan Malviya Cancer Centre, Varanasi

National Cancer Institute, Nagpur

With a total construction area spanning 7.5 lakh square feet and occupying a site size of 14.20 acres, The National Cancer Institute stands as a quaternary care oncology center. Spearheaded by Dr. Abaji Thatte Seva Aur Anusandhan Sanstha (Trust), this initiative showcases visionary leadership. The institution is set to become a 500-bed quaternary care cancer center, boasting a built-up area of approximately 7 lakh square feet, with provisions for future expansion to accommodate up to 700 beds.

Designed as a comprehensive care facility, The National Cancer Institute excels in basic, clinical, and epidemiological research alongside delivering high-quality cancer care. Compliance with both NABH and JCI certification requirements underscores its commitment to excellence in healthcare standards.

- **Location:** Nagpur
- **Owner:** National Cancer Institute
- **Architects:** Hiten Sethi Architects
- **Structural Consultants:** Mahimtura Consultants
- **Main Contractor:** Gannon Dunkerley & Co.
- **Structure Type:** Composite
- **Steelworks:** JSW Severfield Structures Ltd.
- **Classification:** Hospital
- **Steel Works:** 3,00,000 sq. ft
- **Total Steel Used:** 3,000 Tonne



Fig 28 : National Cancer Institute, Nagpur

PICU Muzaffarpur

Introducing the Marvel of Medical Infrastructure: The Country's First and Largest Paediatrics Care Centre.

Imagine a sanctuary of healing, where cutting-edge technology meets compassionate care. The 100-bed paediatrics intensive care unit (PICU) stands tall as a beacon of hope and healing, redefining the standards of medical excellence in our nation.

What sets this remarkable facility apart is its innovative use of structural steel in its construction—a symbol of strength, durability, and resilience. The intricate framework of steel not only ensures structural integrity but also paves the way for architectural marvels that inspire awe and admiration.

Equipped with state-of-the-art machines and world-class medical equipment, the PICU is a testament to the relentless pursuit of excellence in healthcare. Every corner echoes with the promise of healing, offering solace to families in their darkest hours and hope for brighter tomorrows.

At a cost of Rs 72 crore, the PICU stands as a testament to the unwavering commitment to providing unparalleled medical care to our children. But the journey doesn't end here. In the same year, the encephalitis ward (Rs 2.96 crore) and the mother-child hospital (Rs 13.42 crore) were brought to life, each a testament to our dedication to the well-being of our community.

- **Location:** Muzaffarpur, Bihar
- **Owner:** M/s Bihar Medical Services and Infrastructure Corporation Limited
- **Architects:** M/s DDF Consultants Pvt. Ltd
- **Structural Consultants:** Skeleton Consultants Pvt Ltd, Noida, Uttar Pradesh
- **Structure Type:** Composite
- **Classification:** Hospital
- **Design Year:** 2019
- **Construction Year:** 2019
- **Total Built-up area:** Approx. 1,00,000 sq. ft
- **Total Steel Consumption:** Approx. 500 Tonne



Fig 29 : PICU Muzaffarpur

Sri Sathya Sai Sanjeevani Hospital

Introducing the Sri Sathya Sai Sanjeevani Hospital: A Heart Centre for Children on Delhi-Mathura Road. Nestled along the bustling Delhi-Mathura Road in Baltabgarh, the Sri Sathya Sai Sanjeevani Hospital stands as a beacon of hope and healing for children with heart conditions. This super-specialty heart center is more than just a hospital—it's a sanctuary of compassion and cutting-edge medical care. Rising majestically as a G+2 structure, with the provision for an additional floor in the future, the hospital boasts a sprawling built-up area of approximately 147,300 square feet. Its unique design, akin to a complex heart shape, reflects both innovation and symbolism in its unsymmetrical plan.

Stepping inside, one is greeted by a harmonious blend of steel and concrete—a testament to modern engineering and architectural brilliance. Envisaged as a steel-concrete hybrid structure, the hospital's substructure rises confidently in concrete, while its superstructure soars gracefully in structural steel.

Within its walls, the Sri Sathya Sai Sanjeevani Hospital houses state-of-the-art facilities, including numerous operating theaters and intensive care units equipped with the latest advancements in heart care technology. It is here that medical expertise meets heartfelt compassion, paving the way for miracles to unfold and lives to be transformed.

At the heart of it all lies a singular mission: to provide high-quality healthcare services to children in need, irrespective of their background or circumstances. Every corner of this remarkable institution resonates with the promise of healing and the spirit of service.

As the Sri Sathya Sai Sanjeevani Hospital continues to touch lives and inspire hope, it stands as a testament to the power of human resilience, compassion, and the relentless pursuit of excellence in healthcare.

- **Location:** Ballabgarh, Haryana
- **Owner:** M/s Sri Sathya Sai Charitable Trust Bangalore
- **Architects:** M/s Ravi Associates, Bengaluru
- **Structural Consultants:** Skeleton Consultants Pvt Ltd, Noida, Uttar Pradesh
- **Structure Type:** Composite
- **Classification:** Hospital
- **Design Year:** 2016-2017
- **Construction Year:** 2017
- **Total Built-up area:** Approx. 1,47,300 sq. ft
- **Total Steel Consumption:** Approx. 1000 Tonne



Fig 30 : Sri Sathya Sai Sanjeevani Hospital

Light house project under PMAY

Light house project under PMAY is an epitome of modern technology and innovative processes redefining affordable housing for the underprivileged. These projects aren't just about homes being built; they're about futures being reshaped and resilient, comfortable abodes being created for those in need.

At the heart of these endeavors lies the transformative power of steel—a material that isn't just strong, but also versatile and sustainable. By leveraging the unparalleled qualities of steel, construction time is reduced, and homes that stand the test of time are crafted, offering a sanctuary of comfort and security to the less fortunate.

But the Light House Projects are more than just bricks and mortar—they're incubation centers of innovation. Here, new frontiers of technology are explored, boundaries are pushed, and the status quo is challenged by planners, architects, engineers, and students alike. It's a playground of possibilities where ideas take shape, and dreams become reality.

- **Location:** (I) Indore, Madhya Pradesh (II) Lucknow, Uttar Pradesh (III) Agartala, Tripura
- **Owner:** M/s Ministry of Housing and Urban Affairs & BMTPC
- **Architects:** M/s Sthapati Associates Pvt. Ltd.
- **Structure Type:** Composite
- **Structural Consultants:** Skeleton Consultants Pvt Ltd, Noida, Uttar Pradesh
- **Classification:** Residential
- **Design Year:**
 - (I) PMAY Agartala: 2022 - 2023
 - (II) PMAY Indore: 2022 - 2023
 - (III) PMAY Lucknow: 2022 - 2022
- **Construction Year:**
 - (I) PMAY Agartala: 2022
 - (II) PMAY Indore: 2022
 - (III) PMAY Lucknow: 2022
- **Total Built-up area:**
 - (I) PMAY Agartala: Approx. 4,95,000 sq. ft
 - (II) PMAY Lucknow: Approx. 6,00,000 sq. ft
 - (III) PMAY Indore: Approx. 5,00,000 sq. ft
- **Total Steel Consumption:**
 - (I) PMAY Agartala: Approx. 2500 Tonne
 - (II) PMAY Lucknow: Approx. 3500 Tonne
 - (III) PMAY Indore: Approx. 2600 Tonne



Fig 31: LHP Agartala



Fig 32: LHP Lucknow



Fig 33: LHP Indore

IIIT Nagpur, Academic Block- 5 Floor, Admin Block- 3 Floors

The academic buildings for institutions demand a certain approach for its construction. The considerations that are at the forefront of it are:

- Emphasis on the quality of materials, explicit performance specifications, and maintenance criteria
- Ensuring robust material and structural performance to guarantee the longevity and stability of the educational infrastructure
- Recognition of the need for specialized lifting or installation processes
- Dedication to minimizing on-site impacts, noise, and disturbances

The adoption of steel construction in the case of IIIT Nagpur academic building, aligns with the goal of optimizing the construction timeline, with an understanding that off-site fabrication provides resilience against weather-induced setbacks.

- **Location:** Nagpur, Maharashtra
- **Owner:** M/s Ministry of Human Resource Development
- **Architect:** M/s Renu Robin Design Studio
- **Structural Consultants:** Skeleton Consultants Pvt Ltd, Noida, Uttar Pradesh
- **Structure Type:** Composite
- **Classification:** Academic Building
- **Design Year:** 2018-2022
- **Construction Year:** 2022
- **Total Built-up area:** Approx. 1,12,000 sq. ft
- **Total Steel Consumption:** Approx 500 Tonne



Fig 34 : IIIT Nagpur, Academic Block- 5 Floor, Admin Block- 3

Paradise Avenue

Paradise Avenue is designed as Ordinary Moment Resisting Frames (OMRF) with cross bracings ensuring ductile behavior during the earthquakes. Having located in seismic zone V, it is imperative to have a structure flexible and low weight, as heavily structures attract larger forces when an earthquake occurs. 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. Steel structures are generally light in comparison to those constructed using concrete. In Jammu, it is a challenge to take up construction activities across the year citing the climatic conditions. Also, during few months of the year, the working hours are even less than 6 hours in a day.

Temperature during a particular period is much below and concrete quality with respect to workability and its maturity may not be achieved up to the required standards for such a high rise construction. With all these limitations, off-site construction of components was the best solution.

Precast RCC components need a highly sophisticated plant, and also the weight of components is huge from the transportation point of view. Hence, prefabricated steel components which are stronger and lighter in a plant situated anywhere in the country was the best solution.

Selection of structural steel for the building framing system brought numerous benefits to the project.

All other materials were evaluated against structural steel, and steel was the best material of choice.

There are many benefits of using steel in construction, and in this project, steel was selected considering the below factors:

- Speed of construction
 - Definite project costs
 - Reliable and predictable better quality structural system High strength
 - Design flexibility
 - Aesthetic appeal
 - Less carbon footprints
- **Location:** Jammu, India
 - **Owner:** M/s Simula Infra Development
 - **Design team:** Skeleton Consultants Pvt Ltd, Noida, Uttar Pradesh
 - **Architect Name:** M/s. STonneehenge, New Delhi
 - **Structure Type:** Composite
 - **Classification:** Residential
 - **Design Year:** 2019
 - **Construction Year:** 2019
 - **Total Built-up area:** 550000 sq ft
 - **Total Steel Consumption:** Approx 1140 Tonne

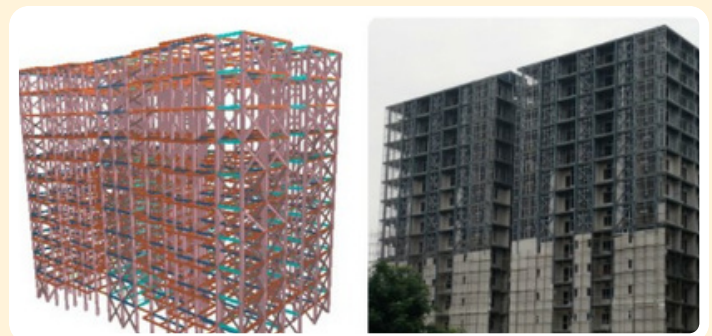
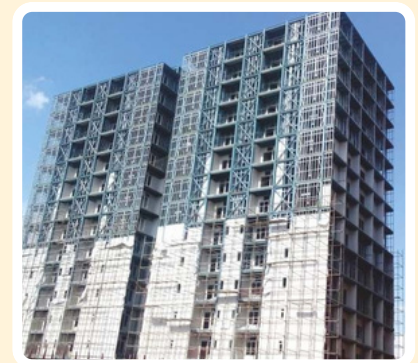


Fig 35 : Paradise Avenue

OTM Accommodation, MES

The project includes 3 nos similar G+3 storey Prefabricated building of Y shape. The built-up area of each building is approximately 85,000 sq. ft. The Y shape building has been divided in 4 parts, 3 wings & a central core, by expansion joints for improved behavior under lateral loads.

The structure is envisaged as a steel-concrete hybrid structure with substructure up to the plinth level in concrete and superstructure in structural steel. The primary frame of the building comprises of moment resisting steel beam-columns frames with cross bracings in vertical plane at suitable locations in line with architects to resist the lateral force due to earthquake and wind and control the deflections. The floor system comprises of steel beam and joist with concrete slab over profiled metal deck sheet. Rigid diaphragms in horizontal direction at floor levels is considered and it is achieved through concrete screed over deck sheet. Hollow tubular sections are considered for Column, Beams & Bracings having yield strength of 310 MPa confirming to IS 4923-2017 & IS 1161-2014. External & Internal walls except wet areas/toilet are LGSF walls. In Wet areas/toilets, AAC block masonry are provided.

- **Location:** Shankar Vihar, New Delhi
- **Owner:** HQ, CE, Delhi Zone MES, Delhi Cantt. .
- **Architects:** M/s Akshaya Jain & Associates, New Delhi
- **Structural Consultants:** Skeleton Consultants Pvt. Ltd., Noida
- **Contractor:** M/s Varindera Constructions Ltd., New Delhi
- **Structure Type:** Steel-Concrete hybrid structure
- **Classification:** Residential
- **Design Year:** 2022
- **Construction Year:** 2022
- **Total Built-up area:** 255000 sq. ft
- **Total Steel used:** 1100 Tonne



Fig 36 : OTM Accommodation, MES

Immigration Centre, Petrapole

A state-of-the-art passenger terminal is nearing completion at the Petrapole land port, poised to revolutionize the movement of individuals between India and Bangladesh. The new terminal is designed to accommodate over 20,000 passengers daily, with a capacity of handling 2,500 passengers simultaneously. The three-tier structure, conveniently accessible from NH35, will feature dedicated counters for immigration and security checks, waiting areas, duty-free shops, a cafeteria, medical facilities, currency exchange counters, belt conveyors, offices, a hostel, and other amenities. Additionally, the basement will accommodate parking facilities. The huge structure visible from the National Highway, is being covered with Steel Roof Arch type structures. The main highlight of the structures are these arches which have varying spans and heights. This segmental differentiation between the structures gives it a very defining and distinct look. The center is being constructed into 3 segments with the length of 100m each. The width of the each sections will be 60m, 55m and 50m and the heights will be 35m ,30m and 30m respectively. The Roof Cladding will have both opaque and translucent sheets to allow part of sunlight for daylighting features. The erection of the arch bridge is being done in parts with each arch section joined together to form the whole arch.

- **Location:** Petrapole, India Bangladesh Border
- **Owner:** Land Ports Authority of India
- **Architecture, MEP & Structure Engineering Services:** Creative Group (For RITES Limited)
- **Contractor:** Shapoorji Pallonji Engineering & Construction
- **Structure Type:** Steel Intensive Roof Arch
- **Classification:** Long Span Buildings
- **Total Built-up area:** 624629.72 sq. ft
- **Total Steel used:** 5922 Tonne

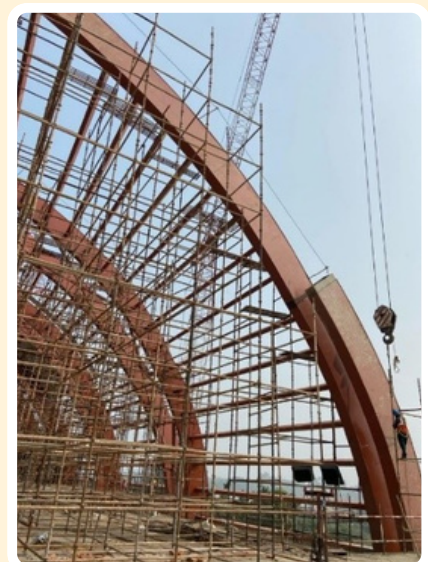


Fig 38 : Immigration Centre, Petrapole

JSW Centre

JSW being one of the leading steel manufacturers, wanted to showcase the potential of steel architectural and structural design and produce a sleek and contemporary design with long spans and large cantilevers and fast-track construction. The building has 10 floors with two basements. The use of tinted glass and double glass walls was to reduce the heat loads considerably. The plan was of eye-shape and had a central atrium for lighting and ventilation. It also has a rain water harvesting system. Overall the building exemplifies the union of architecture and functionality with structural engineering. Complex plan required every member to be numbered to locate it at the right place. The fabricated beams have to be put at the right place and this requires considerable planning at site to reduce handling and erection issues. The unique plan needed large number of fabrication drawings. The eye-shaped plan and reduction in column sizes on the upper floors, necessitated the production of a large number of fabrication and drawings.

- **Location:** Bandra Kurla Complex, Mumbai
- **Owner:** JSW Group
- **Architects:** Stantec Consulting Pvt. Ltd. Ahmedabad
- **Structural Consultants:** LERA – Leslie E Robertson Associates, USA; Kelkar Design Pvt. Ltd., Mumbai
- **Contractor:** Structural Fabrication Pvt. Ltd, Mumbai
- **Structure Type:** Steel Intensive
- **Classification:** Office
- **Total Built-up area:** 550000 sq. ft
- **Total Steel used:** 3300 Tonne

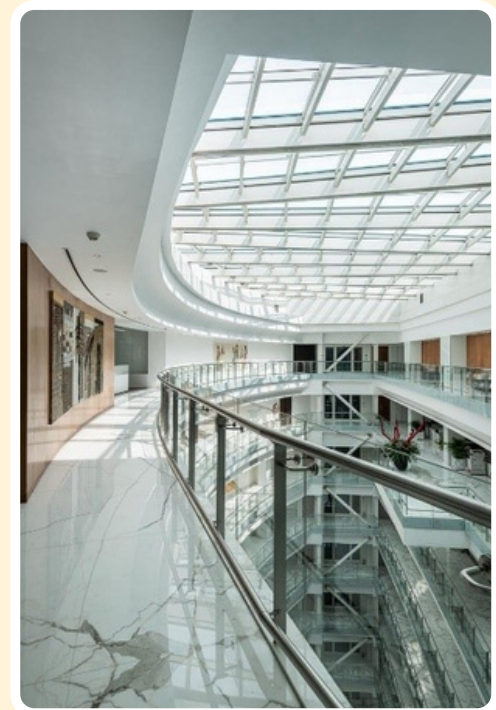
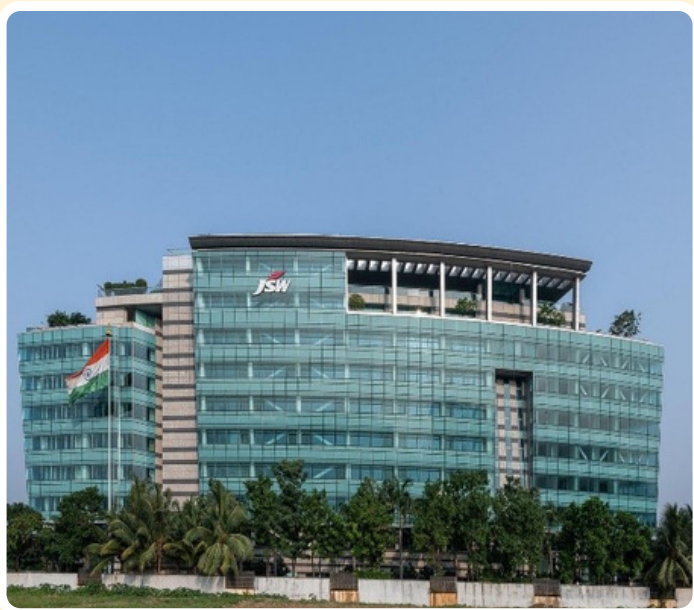


Fig 39 : JSW Centre, Mumbai

R&R Base Hospital

Army Hospital (Research And Referral), commonly referred to as Army Hospital (R&R), AH (R&R), or RR Hospital, stands as the primary and foremost medical care facility catering to the needs of the Indian armed forces. Established in the mid-1990s, this complex, comprising a teaching hospital and nursing college, is situated in Delhi Cantonment, New Delhi. Designing a hospital and nursing college link, R&R involves careful consideration of various factors to ensure functionality, efficiency, and optimal patient care. Here are key considerations for structuring such facilities:

- Space Planning
- Accessibility and Inclusivity
- Technology Integration
- Flexibility and Adaptability
- Safety and Security
- Natural Light and Ventilation

R&R new construction will have 10 floors with an area of approx. 14 Lacs sq ft.

- **Location:** New Delhi, India
- **Owner:** Military Engineer Services
- **Architects:** M/s C.P. Kukreja Architects
- **Structural Consultants:** Skeleton Consultants Pvt. Ltd., Noida
- **Structure Type:** Steel Intensive
- **Classification:** Hospitals
- **Design Year:** 2023
- **Construction Year:**
- **Total Built-up area:** 1400000 sq. ft
- **Total Steel used:** 5500 Tonne

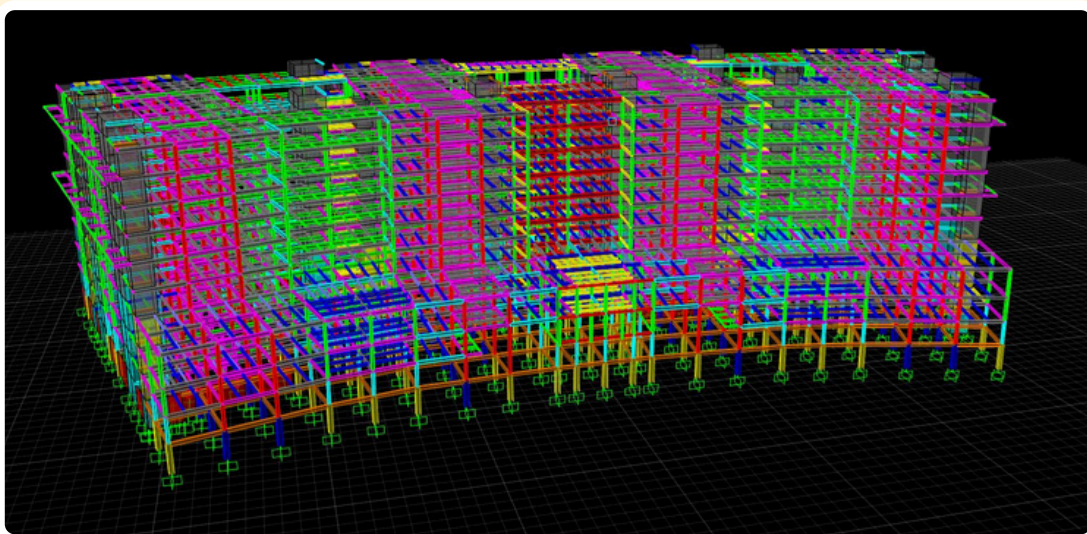


Fig 40 : R&R Base Hospital

ASB MG Engineering College

MG Engineering College under Technical Education is built in the hilly terrains of Rampur, Shimla. For designing academic buildings like ASB MGEC, choosing the right materials is crucial, and steel stands out as an excellent choice for various reasons. One key advantage of using steel in academic building structures is its strength, allowing for the creation of large, open spaces that can be easily adapted to different teaching methods and evolving technologies. This flexibility is particularly valuable as educational needs change over time. Additionally, steel's robustness makes it effective in dealing with challenges like earthquakes, providing a secure structural foundation. Moreover, steel is a sustainable option as it is durable and recyclable, aligning with environmentally friendly building practices. In collaborative spaces, such as common areas and classrooms, the strength of steel enables the construction of expansive spaces while ensuring safety. In essence, the use of steel in academic building design contributes to a safe, adaptable, and environmentally conscious learning environment, making it a valuable asset in the construction of modern educational facilities.

- **Location:** Jeori Rampur, Distt. Shimla
- **Owner:** M/S Ropeways & Rapid Transport System Development H.P Limited
- **Architects:** M/s Credible Management & Consultants Pvt. Ltd
- **Structural Consultants:** Skeleton Consultants Pvt. Ltd., Noida
- **Structure Type:** Steel Intensive
- **Classification:** Academic Building
- **Design Year:** 2023
- **Construction Year:** 2023
- **Total Built-up area:** 23600 sq. ft
- **Total Steel used:** 170 Tonne



Fig 41 : ASB MG Engineering College

Aster Public School

Aster Public School in Greater Noida has 7 floors with a total built-up area of 70000 sqft. The building was completed in October 2018. The primary reason steel was chosen for the construction of Aster Public School is its unparalleled strength and durability. Steel is known for its ability to withstand extreme weather conditions, seismic activity, and other external forces. This ensures a long lifespan for the school building, providing a safe and secure environment for students and staff. Steel structures are known for their quick construction time compared to traditional building materials. The construction of Aster Public School was completed in a shorter timeframe, allowing for a faster occupancy and reduced disruption to the surrounding community. This speed is particularly advantageous in educational projects where timely completion is crucial.

- **Location:** Greater Noida
- **Owner:** M/s Aster Public School
- **Architects:** S.S. Bhatia & Associates
- **Structural Consultants:** Skeleton Consultants Pvt. Ltd., Noida
- **Structure Type:** Steel Intensive
- **Classification:** Academic Building
- **Design Year:** 2018-19
- **Construction Year:** 2019
- **Total Built-up area:** 70000 sq. ft
- **Total Steel used:** 350 Tonne



Fig 42 : Aster Public School

Aster Public School Knowledge Park IV

Aster Public School Knowledge Park IV was completed in the Dec 2019 and has 6 floors with an auditorium. The project was completed in a span of approx 8 months and has a builtup area of about 1.16 Lacs sqft. Aster Public School Knowledge Park, with its six-floor structure predominantly constructed using steel, boasts a cutting-edge auditorium as a standout feature. The innovative use of steel in the auditorium's construction not only ensures structural integrity but also creates a versatile and aesthetically pleasing space for academic and cultural events. Beyond the auditorium, the entire school exemplifies modern architectural design, blending functionality with a forward-thinking approach to education.

- **Location:** Greater Noida
- **Owner:** M/s Aster Public School
- **Architects:** M/s Anand Patners
- **Structural Consultants:** Skeleton Consultants Pvt. Ltd., Noida
- **Structure Type:** Steel Intensive
- **Classification:** Academic Building
- **Design Year:** 2019
- **Construction Year:** 2019
- **Total Built-up area:** 116000 sq. ft
- **Total Steel used:** 900 Tonne



Fig 43 : Aster Public School Knowledge Park IV

TCS Technopark Building

The building, one of the largest in the Asian continent, accommodates around 30,000 professionals. The salient features of the project are the 132m high signage tower and the dinosaur shaped 300m long and 45m high central spine. There are six Engineering buildings, besides several others.

The Engineering buildings have an interesting architecture in that, these are butterfly shaped in plan with wings on both the sides of the central core. The magnificent dragon shaped Central Spine covers the podium standing erect between the two rows of General Service buildings. The huge structure presented many challenges in fabrication as well as erection. The total quantum of steel work constituted more than 200,000 nos. of bent pipes to produce a finished product of 7200MT, which required 9000 MT of raw steel. The structural steel work including the supporting system was successfully completed in 24 months incurring 315,000 man-days.

- **Location:** Techno Park IT Project, Chennai
- **Owner:** Tata Consultancy Services
- **Architects:** M/s Carlos OTT Architects, Uruguay in association with M/s Carlos Ponce de Leon Architects
- **Indian Architect:** M/s C.R. Narayana Rao
- **Contractor:** M/s Larsen & Toubro Ltd.
- **Structure Type:** Steel Intensive
- **Classification:** Office
- **Total Built-up area:** 2690978 sq. ft
- **Total Steel used:** 7200 Tonne

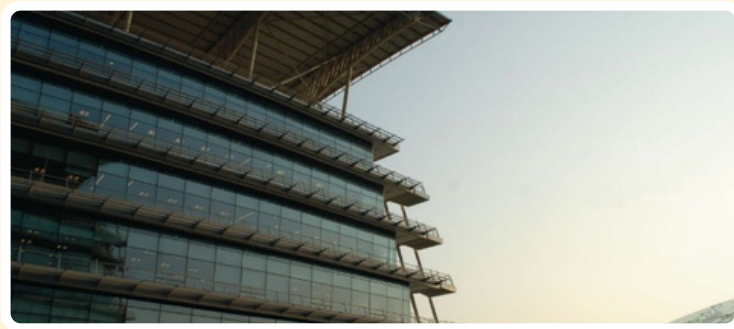


Fig 44 : TCS Technopark Building Chennai

CIDCO Exhibition & Business Centre

CIDCO Ltd, who are the statutory planning authority for Navi Mumbai, have built a permanent Exhibition Centre in Navi Mumbai. The complex comprises of Exhibition Centre and a Business Centre with Auditorium, which are linked by a pedestrian footbridge to allow for seamless movement through the 2 centers. The structure is doubly curved steel roof that has a wave-like form with varying height roof along the width and length with the central roof section at higher level for natural lighting of the inside space, and supported on 16 V-columns. The Auditorium of 600+seats of the Business center comprise of steel trusses for the roof with 10m cantilever to support suspended glazing on steel framework. The type of structural sections used in this structure were Angle Sections, I-sections, Channel Sections, SHS/RHS, tubes etc.

- **Location:** Vashi, Navi Mumbai, Maharashtra.
- **Owner:** City and Industrial Development Corporation of Maharashtra Ltd (CIDCO).
- **Architects:** Ratan J Batliboi Architects Private Limited
- **Structural Consultants:** Shirish Patel & Associates Consultants Private Limited
- **Contractor:** IVRCL Infrastructures & Projects Ltd..
- **Structure Type:** Steel Intensive Steel Roof
- **Classification:** Long Span Buildings
- **Total Built-up area:** 392882 sq. ft
- **Total Steel used:** 3800 Tonne



Fig 45 : CIDCO Exhibition & Business Centre Vashi, Navi Mumbai

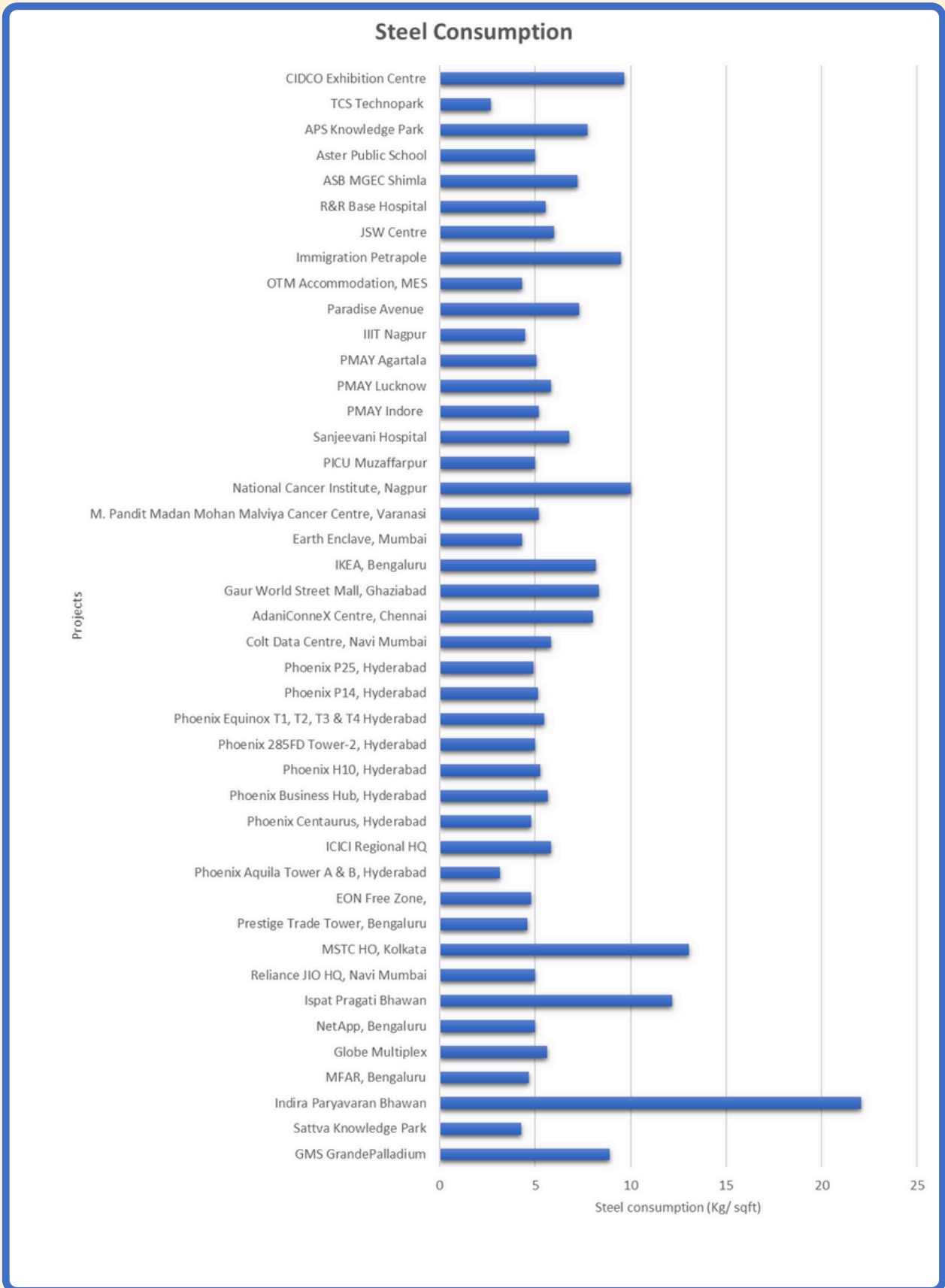
Study highlights:

The study meticulously studied 43 projects situated throughout India, representing a diverse array of regions and sectors. Encompassing both completed initiatives and those in the advanced stages of finalization, the analysis delved into the intricacies of each project to gain comprehensive insights into their impact and progression. The primary results are tabulated in the table as follows with steel consumption derived from steel used and floor area of the structure.

Structure Name	Type of Building	Steel Used (Kg)	Floor Area (sq ft)	Steel Consumption (kg/sq ft)
GMS GrandePalladium	Office	1600000	180000	8.9
Sattva Knowledge Park, Hyderabad	Office	20000000	4700000	4.3
Indira Paryavaran Bhawan	Office	684000	31000	22.1
MFAR, Bengaluru	Office	2800000	600000	4.7
Globe Multiplex	Retail	365000	65000	5.6
NetApp, Bengaluru	Office	7000000	1400000	5.0
Ispat Pragati Bhawan	Office	365000	30000	12.2
Reliance JIO HQ, Navi Mumbai	Office	6000000	1200000	5.0
MSTC HO, Kolkata	Office	769000	59000	13.0
Prestige Trade Tower, Bengaluru	Office	2200000	480000	4.6
EON Free Zone,	Office	800000	166840.61	4.8
Phoenix Aquila Tower A & B, Hyderabad	Office	9500000	3000000	3.2
ICICI Regional HQ	Office	25000000	4305564	5.8
Phoenix Centaurus, Hyderabad	Office	10500000	2200000	4.8
Phoenix Business Hub, Hyderabad	Office	12500000	2200000	5.7
Phoenix H10, Hyderabad	Office	10500000	2000000	5.3
Phoenix 285FD Tower-2, Hyderabad	Office	5000000	1000000	5.0
Phoenix Equinox T1, T2, T3 & T4 Hyderabad	Office	18600000	3400000	5.5
Phoenix P14, Hyderabad	Office	12300000	2400000	5.1
Phoenix P25, Hyderabad	Office	11800000	2400000	4.9
Colt Data Centre, Navi Mumbai	Data Centre	3500000	600000	5.8

Structure Name	Type of Building	Steel Used (Kg)	Floor Area (sq ft)	Steel Consumption (kg/sq ft)
AdaniConneX Centre, Chennai	Data Centre	4000000	500000	8.0
Gaur World Street Mall, Ghaziabad	Retail	7500000	900000	8.3
IKEA, Bengaluru	Retail	4500000	550000	8.2
Earth Enclave, Mumbai	Retail	2150000	500000	4.3
M. Pandit Madan Mohan Malviya Cancer Centre, Varanasi	Hospitals	3000000	580000	5.2
National Cancer Institute, Nagpur	Hospitals	3000000	300000	10.0
PICU Muzaffarpur	Hospitals	500000	100000	5.0
Sanjeevani Hospital	Hospitals	1000000	147300	6.8
PMAY Agartala	Residential	2500000	495000	5.1
PMAY Lucknow	Residential	3500000	600000	5.8
PMAY Indore	Residential	2600000	500000	5.2
IIT Nagpur	Academic Buildings	500000	112000	4.5
Paradise Avenue	Residential	1140000	156000	7.31
OTM Accommodation, MES	Residential	1100000	255000	4.3
Immigration Petrapole	Special Buildings	5922000	624629.72	9.5
JSW Centre	Office	3300000	550000	6.0
R&R Base Hospital	Hospitals	5540000	100000	5.54
ASB MGEC Shimla	Academic Buildings	170000	23600	7.2
Aster Public School	Academic Buildings	350000	70000	5.0
APS Knowledge Park	Academic Buildings	900000	116000	7.8
TCS Technopark	Office	7200000	2690978	2.7
CIDCO Exhibition Centre	Special Buildings	3800000	392882.7303	9.7

The depicted graph provides a visual representation of the steel consumption patterns observed across the entirety of the projects under consideration:



The structures are classified into seven broad distinctions based on their use:



The buildings classified under Office are:

- GMS GrandePalladium
- Sattva Knowledge Park
- Indira Paryavaran Bhawan
- MFAR, Bengaluru
- NetApp, Bengaluru
- Ispat Pragati Bhawan
- Reliance JIO HQ, Navi Mumbai
- MSTC HO, Kolkata
- Prestige Trade Tower, Bengaluru
- EON Free Zone,
- Phoenix Aquila Tower A & B, Hyderabad
- ICICI Regional HQ
- Phoenix Centaurus, Hyderabad
- Phoenix Business Hub, Hyderabad
- Phoenix H10, Hyderabad
- Phoenix 285FD Tower-2, Hyderabad
- Phoenix Equinox T1, T2, T3 & T4 Hyderabad
- Phoenix P14, Hyderabad
- Phoenix P25, Hyderabad
- JSW Centre
- TCS Technopark

The buildings classified under Retail are:

- Globe Multiplex
- Gaur World Street Mall, Ghaziabad
- IKEA, Bengaluru
- Earth Enclave, Mumbai

The buildings classified under Data Centre are:

- Colt Data Centre, Navi Mumbai
- AdaniConneX Centre, Chennai

The buildings classified under Hospitals are:

- M. Pandit Madan Mohan Malviya Cancer Centre, Varanasi
- National Cancer Institute, Nagpur
- PICU Muzaffarpur
- Sanjeevani Hospital
- R&R Base Hospital

The buildings classified under Academic buildings are:

- IIIT Nagpur
- ASB MGEC Shimla
- Aster Public School
- APS Knowledge Park

The buildings classified under Residential are:

- PMAY Indore
- PMAY Lucknow
- PMAY Agartala
- Paradise Avenue
- OTM Accommodation, MES

The buildings classified under Special Buildings are:

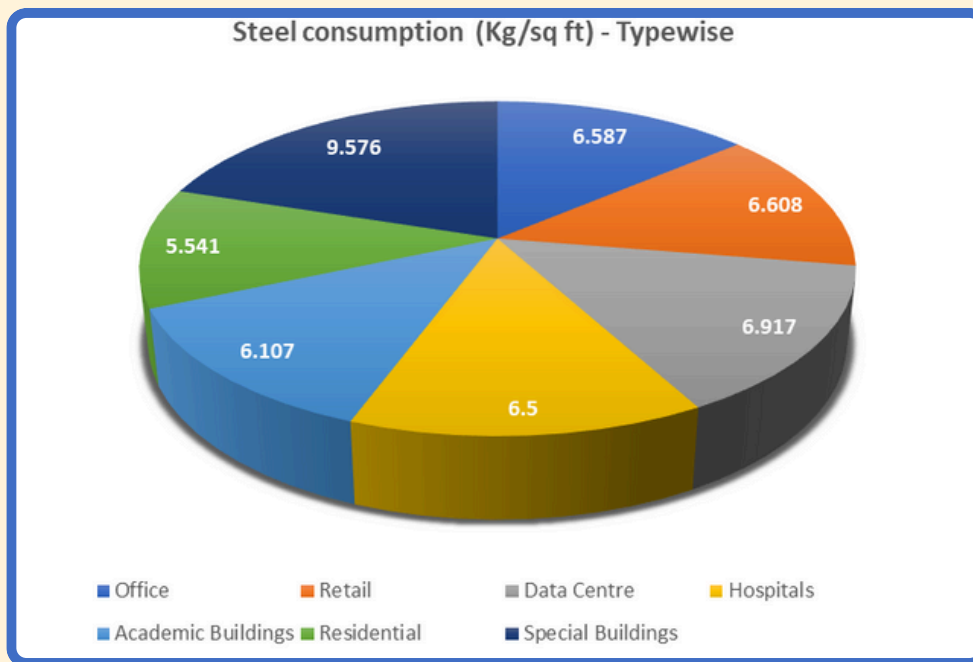
- Immigration Petrapole
- CIDCO Exhibition Centre

Data Average:

An evaluation for outliers was undertaken across distinct building categories such as Office, Retail, Data Centre, Hospitals, Academic buildings, Residential and Special Buildings. The analysis concluded that none of the datasets exhibited any outliers. According to this study, the average steel consumption in commercial steel-intensive buildings stands at 6.57 kg per square foot. Subsequently, we opted for the application of the arithmetic mean as the preferred method for computing the average of the available data. The arithmetic mean of the group data under Office, Retail, Data Centre, Hospitals, Academic buildings, Residential and Special Buildings are as follows:

Type	Steel Consumption (kg/sq ft)
Office	6.60
Retail	6.61
Data Centre	6.92
Hospitals	6.5
Academic Buildings	6.11
Residential	5.541
Special Buildings	9.58

Pie Chart depicting the values for each type is as follows:



Observations:

- The special buildings category exhibits the highest utilization of steel, exemplified by projects like Immigration Centre Petrapole and CIDCO Exhibition Centre. This heightened consumption can be attributed to the unique characteristics of these buildings, including their arch-shaped designs and expansive roof systems
- In the context of residential buildings, the adoption of the apartment system, coupled with the government's emphasis on 'Housing for All,' results in predominantly 1 BHK and 2 BHK configurations. This configuration choice, characterized by smaller spans, contributes to a relatively higher consumption of steel in these structures

Points of Consideration for Industry

- The residential sector, with its growing emphasis on apartment-style dwellings, presents an intriguing prospect for the future. As apartment configurations gain popularity and real estate builders strive to maximize Floor Area Ratio (FAR), the increased adoption of steel in these buildings is expected to drive up steel consumption
- In the realm of special buildings like the Immigration Centre Petrapole and CIDCO Exhibition Centre, the distinctive characteristics of these buildings may necessitate an augmented use of steel in their construction

Conclusion:

The study on steel consumption per square foot yields valuable insights into the intricate relationship between construction materials and building design. After analyzing the data, it becomes evident that steel consumption per square foot is influenced by various factors including building type, design complexion, structural & architectural requirements.

Residential buildings exhibit lower steel consumption compared to their commercial counterparts. However, they still surpass other building types in terms of due to the necessity of accommodating column positioning, which is essential for integrating diverse architectural layouts within individual apartments.

For stakeholders in the industry, the report aims to reinforce the importance of understanding steel consumption trends across various use. The conclusions drawn in this report can lay the groundwork for future studies, offer recommendations to stakeholders for understanding the factors influencing steel consumption patterns and develop strategies to optimize them.

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