

# STERLING

**ENGINEERING CONSULTANCY SERVICES PRIVATE LIMITED**

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Featured Project:  
**ICICI Regional  
Head Quarters, Hyderabad**

Research & Development:  
**BIM and REVIT Structures**

Palais Royale in UK Magazine  
'The Structural Engineer'



## ICICI Regional Head Quarters, Hyderabad

### Introduction:

This large office complex has been recently completed in the IT hub of Gachibowli in Hyderabad for ICICI Bank. This is said to be the largest single office building used by a single owner for a single business field in India and the 18th largest building in the world in terms of floor area available. The total built up area including basements is four lakh sq. mt. and accommodates 22,000 employees.

### Architectural Planning:

The plot is 300 m long and 80 m wide. A typical floor plate is as large as 260 m x 64 m. The building has three full basements and partial fourth one, above which there are four podium levels and then twelve typical office floors. Designed by Architect Hafeez Contractor, this building has an impressive six floor high atrium in the entrance lobby. The building facade comprises of three blocks which are connected by elevational features such as hanging gardens, tree windows and bridges.

The basements accommodate the car parking areas. The building also houses restaurants, gymnasium, meeting places, lounges, banking halls, office spaces, training centres, auditoria, guest house cum dormitory for trainees arriving from outstation, vaults, call centre, data centre and other banking related activities.

### Structural Scheme:



In the times of economic surge and rapid growth in India, ICICI Bank set a goal for the building to be completed in just 18 months. In order to achieve this seemingly impossible objective, it was decided to construct the building as a composite structure. A very aggressive schedule was chalked out as soon as the architectural planning was frozen. The general grids were finalized for the excavation and the construction of the basement commenced.

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 idea was to achieve substantial progress on the project during the period for ordering and procuring huge quantities of structural steel members that were required for the construction of the super-structure above podium level. Due to sequential construction

requirement for RCC/ PT slabs, time duration for basement and podium was fixed as nearly 9 months, leaving only 9 months construction period for the 12 typical structural steel floors in the tower.

The Gachibowli terrain is strewn with huge boulders, almost like a moraine. Below this surface is a stiff layer of highly weathered rock and at about six meters depth there is a mass of very hard rock. At the site, the rock level dipped along the length of the plot. The rock strata offered excellent bearing capacity for the foundation design to carry huge loads, to the tune of almost 4000 Tonnes on some of the columns.

The impressive atrium in the entrance lobby is almost six floors high. This high volume space was achieved by using transfer trusses spanning 30 m which in turn carried the load of the 12 upper floors. Due to lifting capacity constraints, these trusses were fabricated in three parts each and then assembled in-situ with the help of holding cranes. 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. Fabricated plate girders spanning 10 to 30 m were provided to transfer loads from the columns above.

Typical Floor grid was fixed as 10.9 m x 10.6 m with secondary beams spaced at 3.55 m c/c. In order to save time for fabrication, readymade rolled British Standard sections were imported. Deck slab of overall depth of 170 mm was adopted using Corus Deckspan Comflor 80. The secondary beams were designed with composite action. Primary beam spans were 10.6 m and designed with partial moment connections. The overall structural depth turned out to be 785 mm, within the floor to floor height of 4.0 m, which was accepted by architects and MEP consultants.

In order to achieve an approximate construction cycle at 6-7 days, an aggressive construction sequence for superstructure was adopted. While columns of height 8 to 12 m were erected, beams were erected at 2 or 3 levels almost simultaneously. Pre-cut deck-sheets were laid over the beams, shear connectors welded and reinforcement tied. No propping was required; hence the construction cycle was practically complete with the laying of deck-sheets. Concreting was the last activity, but was out of the critical path.



ComFlor 80 deck sheets were chosen after comparing them with an alternative design using Comflor 60 with more secondary beams. Composite action ensured saving in secondary beam weight. Use of deck sheets eliminated the need of shuttering system, relieving the contractor of space and storage requirements for the formwork and staging materials. Since there was no propping, services and other installations could start immediately after curing of concrete above deck-sheets. The deck-sheet layout drawing was prepared based on structural drawing. After Sterling's approval, cut to size deck-sheets were ordered. The deck-sheets were received on site with appropriate marking. Geometrically no further check was required on site as the entire cutting was pre-planned on the drawings. Non-standard areas to an extent of about 5 to 10% were dealt with on the site itself. Since length of sheet was one full grid, local inaccuracies in steel erection could be covered at the edges on beams.

Columns were encased in structural concrete to reduce steel consumption and also to protect them from fire and corrosion. Beams and bracings were coated with vermiculite. Exposed structural steel members, wherever used as architectural expressions, were treated with intumescent fire retarding paints. The concrete lift cores, which also acted as shear wall elements, were slip formed in advance of the structural steel erection.

In all, about 30,000 M. Tons of structural steel was used and about 2,00,000 sq.mt. of deck sheets were used in this building.



### Co-ordination:

Although Sterling has been involved in many structural steel building designs, for many other agencies that participated in the planning and design of the ICICI building, this was a new experience. Our team assumed a leader's role in presenting alternatives, explaining the possibilities and constraints of accommodating services and interiors, sequence of construction, temporary props and bracings and other quality related matters to designers, engineers and project managers. Fortunately, the discipline to be followed in the steel design and construction was appreciated by the architects, MEP engineers, façade contractors and the general contractor. Although architects threw many challenges by introducing extraordinary architectural features generally associated with the usual concrete buildings, all of them could be accommodated without compromising the principles of steel construction.

### Quality Control:

Sterling played an extremely important part in ensuring quality in all aspects of design, drawings and even construction. Along with use of sophisticated analysis softwares for the whole structure, composite members, decksheets, slabs etc., extensive optimization exercises were carried out to arrive at the best economical grid and secondary beam spacing. All the time, consideration was given to the requirement of fast construction. Hence, the emphasis was on the minimum number of units to be erected – columns, beams, deck sheets etc. – using the resources available with the contractor. Accordingly, the drawings made were very elaborate and in detail, inviting very few explanatory queries from contractors during construction, except where changes were needed due to site anomalies. The amount of work put in by our draughting team can be gauged by the number of drawings and sketches prepared – 600 A1 sheets, just by two draughtsmen in 20 months! Limited use of STRUCAD was also made to explain with clarity some complex structural connection details.

Our site quality monitoring team took it upon themselves to bring various aspects of design intents and associated quality standards expected to the attention of the contractor's men on the field and in the workshop. A systematic checklist was developed to ensure sequential fabrication and erection procedure for all elements. Periodic inspections by our team were useful in identifying deviations from the intended quality standards and in rectifying them on the spot, or expediting the process by direct communication from site to the design office.

### ✦ Sterling's Team at ICICI:



Vishwas Date



Devang Sutaria



Mrs. Periera



Vinayak Bhogale



Jitendra Kini



Abdul Hafeez



Sanjay Kharinar

## Recently Completed Projects

### Solitaire Residential Tower, Powai, Mumbai *Write-up by Ashok Sawant*

Solitaire is a high rise residential building enjoying a prominent location on the main road leading to IIT, Powai. This building, developed by the Wadhwa group, has a unique plan resembling two squares merging into one another. The first residential floor starts 10 meters above the existing road level which enables all the residents to get an unrestricted view of the vast Powai lake. The overall plan dimensions at the typical floors are 27 meters x 33 meters and the total height of the building is 90 meters above ground level. The building comprises of one basement, two podium levels, one stilt and 27 upper floors. Each residential floor houses two lavish flats with 3.0 meters projecting balconies serving as flower beds and reflecting water bodies.

The residential floors are designed as flat slabs without drop panels and periphery beams. Solid square columns are placed at a grid interval of 6 meters x 6 meters with rectangular columns at the periphery. A solid RCC lift core at the centre provides lateral stability to the building.



### A-Type Towers, Godrej Garden Enclave, Vikhroli (E), Mumbai

*Write-up by Aakash Badjatya*



This group of six identical, eye-catching buildings is easily noticed while driving along the Eastern Express Highway in Vikhroli. Developed by Godrej & Boyce Ltd., the buildings are unique in terms of architectural expression as well as functional planning. Essentially, A (or airplane) shaped in plan, these 20 storeyed buildings are designed by architect Mr. T. Khareghat. These buildings are symmetric in plan and are about 70 meters tall.

Machine-like elevational treatment with punched-in windows and sharp edges almost dictated the use of precise, pre-engineered formwork. All the external surfaces – including box type projections – are cast in concrete as one continuous monolithic surface using MIVAN shuttering. This eliminated the problems of seepage of rainwater through joints between brick walls and RCC frames which generally occur in conventional construction. Mivan formwork provided a good finished concrete surface which helped in

reducing the cost of plastering from the outside. The buildings were finally finished with a strong, flexible and durable paint. This project has a separate club house with a gymnasium and swimming pool which is also designed by Sterling.

### Radisson Hotel Lobby, Goa *Write-up by Ashok Sawant*

The Client, decided to construct an impressive Entrance Lobby for his new hotel building in South Goa. This massive lobby covering 21 meters x 21 meters area in plan, connects two adjoining wings of the hotel.

A complex three dimensional steel structure forms the roof for the lobby 17 meters above the Ground Floor. The roof structure is supported on 16 circular hollow structural steel columns spaced on a grid of 7 meters in both directions. The roof structure comprises of a number of small trusses of unique shapes and sizes which were originally intended to support an intricate suspended false ceiling. However, as the erection of the entire truss headed towards completion, the structural framework started revealing its beauty. Once the erection work was complete the idea of covering the roof structure by a false ceiling was scrapped by the Client. The trusses were painted white and left exposed to enhance the glory of structural steel construction. An elegant structural steel suspension bridge at 3 meters height above lobby level provides a convenient access between the two wings at first floor level. The bridge is supported by tie rods suspended from the columns in the lobby. To protect the Lobby from the fury of the heavy rain, the east and west façades are covered with unique screens reflecting the traditional Goan architecture. The huge trellis work is constructed by using imported 50mm x 100mm PVC tubes backed by clear acrylic sheets to protect the lobby from strong winds. The entire screen is designed for heavy lateral loads and is mounted on the steel framework.



## ➤ Kohinoor City Mall, Kurla *Write-up by Nilesh Karmalkar*



Kohinoor city mall is a high end commercial building in Kurla, on a busy street leading to Vidyavihar Station in Mumbai. The structure comprises of a huge shopping mall at Ground and First floor levels. The second, third and fourth floors are developed as office spaces.

The overall length of the building facing the main road is 230 meters. The total height of the building is restricted to 30 meters above ground level due to close proximity to the airport. The building comprises of two basements a Ground Floor and 7 upper floors. There are four expansion joints dividing the entire complex into five approximately equal parts.

Floors are generally designed as flat slabs with drop panels to facilitate installation of air-conditioning ducts and other services. There are beams only along the periphery and around the large openings. Square columns are placed on a grid of 10.2 meters x 8.0 meters with rectangular columns along the periphery. This spacing also takes care of an efficient car parking layout in the basement.

The Mall has a grand atrium with a height of 18 meters and plan dimensions of 31 m x 38.6 m. Six large steel columns support the atrium canopy. The columns are fabricated using pipe sections of size NB 300. The top of each of these columns support 4 inclined banana trusses formed using NB 65(M) pipes.

There are two large skylights in Zone 2 and Zone 4 of the Mall. These skylights measure 26 m x 30 m in plan and are at a height of 11.4 m above ground floor level. Four triangular banana shaped trusses span 26 m in order to support the skylight roof.



## ➤ Presently Under Construction:

### ➤ MRR Children's Hospital, Worli *Write-up by Ashok Sawant*

This high rise building is a Super Specialty Pediatric world class hospital which also provides residential accommodation for patients' relatives and guests. This upcoming hospital is located along Dr. Annie Besant Road in Worli.

The proposed structure comprises of two Basements, a Ground Floor and thirty five upper floors which accommodate three levels of parking, 14 Hospital floors and 18 residential floors. The total height of the building up to terrace is approximately 170 m with the provision of a helipad at the roof level. The building is essentially a R.C.C. framed structure with flat slabs. The columns and shear walls are connected to each other with a network of beams and slabs with the slabs acting as in-plane rigid diaphragms.

The overall plan dimensions at ground floor are 33 m x 61m. These dimensions remain constant for the hospital floors above forming a large podium. The building dimensions reduce dramatically to 33 m x 17 m at guest floors above the hospital, resulting in a unique shape to the building. The column configuration changes drastically in the hotel building above. Floor deep R.C.C girders are provided at 17th floor level to support the columns and shear walls above



## Down Memory Lane

### ICICI Headquarters, Bandra Kurla Complex, Mumbai

In the year 1995, ICICI Bank decided to start work on its ambitious project of constructing their central corporate office building in Bandra Kurla Complex, Mumbai.

Being hardcore bankers, the Clients knew the importance of early completion of the project and were willing to incur additional expenses on the structure to achieve their target.

A suitable founding layer was available at approximately 7m below ground. This enabled the construction of two basements for car parking and MEP services. Without wasting any time construction of diaphragm walls along the periphery was commenced and simultaneously, open excavation was started in the central zone under the towers blocks. Immediately after reaching the founding layer, RCC raft foundation was laid under each service core. Thus construction of the core walls could commence immediately using “slip forming” technique. While this was in progress, diaphragm walling could be completed and installation of pre-stressed anchors followed. This permitted the balance excavation work to progress up to the boundaries of the plot.

While all these activities were in progress at site, Clients successfully imported special high-strength steel sections from Trade Arbed – well known steel producers from Belgium. These sections - weighing as high as 500 kg / m – were used as columns. The entire steel fabrication work was carried out in six different locations simultaneously!

As the construction of main raft – complete with inverted foundations for the columns – progressed in all directions, steel columns were systematically brought to the site in 40 ft long trailers and were directly erected in position by using a heavy duty crane. This crane was mounted on rails between the two towers to satisfactorily cover the floor plate of both tower blocks.

Erection of all the steel work progressed very rapidly and was quickly followed by construction of cast-in-situ floor slabs as well as encasing of steel columns. The entire design was carried out taking full advantages of composite construction. Clients acknowledged the advantages of steel construction and admitted that the extra cost of approximately Rs. 100/- per sq ft towards the structure was completely justified because of the saving of six months in construction time.

A unique feature of this project is the boardroom structure spanning between the two buildings at 10th floor level. This is designed like a bridge and rests on suitable neoprene pads at both ends.



## Research & Development at Sterling:

### BIM and REVIT Structures: *Write-up by Mayur Patil*

Building Information Modeling (BIM) is the overall process of creating a single three dimensional database from various disciplines, like Architecture, Structural Engineering, MEP, PMC, etc. to see how they physically interact. It allows designers to make necessary adjustments starting from concept stage to actual construction. REVIT family, which includes REVIT Architecture, REVIT Structures, REVIT MEP, is a leading application suite used for BIM. REVIT Structures allows creating a three dimensional physical and analytical model of a structure simultaneously which include load data, material properties, offsets, etc. This model can be exported to ETABS for analysis and design and any changes made there can be delivered back to REVIT, updating all drawings, BOQ, etc. automatically. Use of unified, cohesive environment like REVIT eliminates duplication of activities amongst consultants, which increases accuracy, efficiency and quality of work.

REVIT is presently being used for modeling of 5 storey Podium of RA Associates project. The starting point for modeling was to import corresponding architectural drawings for each floor and then deciding column locations. Since the column placed on one level can be referred on every floor, the interference of columns with different parking layouts and driveways on other floors could be instantly checked. Also, after completing modeling in REVIT, the GA drawings and ETABS models were prepared in very short time since the analytical model was built-in.

In Godrej project, Sterling is supposed to issue Bar Bending Schedule (BBS). Earlier 2 to 3 persons were involved in this work. With the use of REVIT and Structural Detailing (ASD), this work was carried out by single draughtsman, which resulted into saving of 40% man hours and that too with much better accuracy.

## Recent Events



On the 15th of July, 2011, a seminar was organised by ISSE and JSW.

As the Chairman of the Indian Society of Structural Engineers, Mr. Kamal Hadker addressed the conference.

The topic was "Emerging Trends and Opportunities in the use of Steel in Construction".

A seminar was organised by the Institute of Lean Construction Excellence on 23rd July 2011. This event was held at Sardar Patel College of Engineering at Andheri. Mr. Girish Dravid spoke about "Alliance Contracting with TATA Realty in Chennai" and delighted the audience by his presentation of our on-going project on how Lean Principles are having an impact on project performance, cost, time and delivery.

An international event was organised on Metal Buildings and Steel Structures - Expo 2011, at Pragati Maidan, New Delhi from June 23rd to 25th, 2011. Mr. Kamal Hadker was the Chief Guest and Keynote Speaker at this event which was attended by professionals connected with the steel industry.



Mr. Hadker spoke about the recent development in Steel Structures in India and the future of steel buildings. In his presentation, he gave examples of a number of steel structures designed by Sterling in the past three decades and also highlighted the advantages and disadvantages of steel structures.

It was a pleasure to watch this event on Zee Business News which was telecast on Saturday 16th July, 2011.

The 4th Edition of the show, MBSS'12 will be held from 12th to 14th April 2012 at Bombay Exhibition Centre (BEC), Mumbai.

The Confederation of Indian Industries invited Mr. Kamal Hadker for the Steel Tube Summit in New Delhi on 26th August 2011. Mr. Hadker spoke about the advantages of using pipe sections in steel and showcased some of the recent projects completed by Sterling using pipe sections.

## Creative Strokes

This beautiful decoration has been made by our senior draftsman Suhas Patil. He has been preparing many such delicately carved designs for Ganapati festival year after year!

## Courses attended by our staff members:

"Consulting engineers Association of INDIA" and "Institute for steel development and growth, Kolkata" had organized a two day course on "IS:800-2007, Code of practice for general construction in steel (Third Revision)".

This seminar was attended by Abhijeet Gundaye (from BKC office) and Ashok Sawant (from Bandra office).

The course contained features and introduction to clauses of new IS code. Design examples of structural members and their connection details were also covered during the said course.

Jayant Mistry (from BKC office) attended a course on "Revit (Structural) Software" from "Autodesk". The course covered all aspects of 3D modeling of structures and exporting the results (e.g. plans, sections, quantities etc.) to CAD file.

## Congratulations and time for celebrations!

**Our MIS and Administration Team had lots to celebrate in June and July.**

- ❖ Meenal and her husband Manish were blessed with a cute baby girl on the 9th of June 2011. With radiant smiles they have named her Trishaa.
- ❖ Miracles and magic brought joy to Maya and her husband Uday as they celebrated the arrival of their baby boy, Prathamesh on 17th July 2011.
- ❖ Sangeeta Wakadikar, our engineer from BKC office, got married on 28th May in Nagpur. We congratulate the newly wed couple on this happy occasion.
- ❖ Congratulations to our engineer Ashok Sawant who recently got his Structural Engineer's license from BMC.
- ❖ We were pleased to know that our draftsmen from Bandra west office, Chandrashekhar Tambe and Anand Bhingude have successfully completed their Diploma in Civil Engineering! These hard working young men went to Bhagubai Mafatlal Polytechnic at Vile Parle, after working hours for the last four years. They have been very good draftsmen but are now ready to take on the role of junior engineers! We wish them every success for their new roles.



Editorial



As I write this column, the rains have receded over our city! What remains is the smell of damp earth and trees with fresh green foliage. The rains are always welcome and on stormy, thundering nights they remind us of nature's fury and how much we are at the mercy of nature itself.

Vinda's column takes us straight from the chaos of the city to the peace and tranquility of the

mountains. Do read her extended article - it is as refreshing as visiting the place itself!

With our increasing dependency on artificial products and lifestyle choices, we must think about how much harm is caused to our environment due to the way we live in an urban setting. Be it water pollution, noise pollution, air pollution or over utilization of our natural resources. Our actions and choices are impacting the environment and hence our future in an irreversible manner.

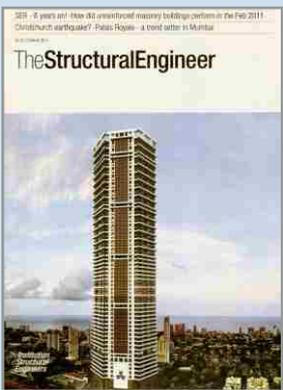
Our initiative this quarter has been to spread awareness about wisely utilizing these resources and in turn cutting costs. Our ERP team members went about spreading the awareness and implementing wonderful ideas in all our branches for saving paper, ink, electricity, water and other resources we so often take for granted.

As an organisation aware of the impact of its actions on the environment and its duty towards socially responsible behaviour, we must increase our sensitivity towards the surroundings and making the right choices not only at home but also in our offices.

Our feature article this time is the mammoth ICICI Bank project. You will also enjoy reading about our completed projects as well as our recent events section. We encourage you once again, to take this issue home, discuss the projects and ideas with your family and invite them to share their views!

Happy Reading!  
Dr. Deepali Hadker

The Structural Engineer



We are proud to announce that our on-going project Palais Royale was recently featured in the most respected magazine published by the Institution of Structural Engineers, UK called "The Structural Engineer". The article was published in the 15th March 2011 issue and was titled "Palais Royale: A Trend Setter in Mumbai". Needless to say our entire organisation is very proud of having this Indian project published on the front page of a world renowned magazine.

High On Himalayas

You all know that Girish Sir was away from office for about ten days in the month of July, travelling with his family in the Himalayas.

"High on Himalayas" is an account of our breath-taking yet adventurous journey in the rugged mountains of the North. However, it is impossible to describe the beauty of the experiences in the space available. Below are a few excerpts from the original article. For the complete and detailed account and more photographs of the journey visit [www.lettuce-eat.info](http://www.lettuce-eat.info) and look for the post titled "High on Himalayas"



Clouds settling over the valley in Kalpa



*"...From Chandigarh, we drove towards the Shivaliks - the lush green foothills of the Himalayas. The road gradually gained elevation, the air took on a tone of crisp freshness and cool and the trees changed from tropical to temperate - pine and firs, in a matter of four hours. As we climbed higher up, the roads almost entirely consisted of sharp hair-pin bends, expansive views of deep, green valleys and lofty peaks rising amidst dense clouds on one side and sheer rock faces on the other. Many a times, the clouds settled low on the roads so that visibility was reduced to about 20 feet! We passed through small villages, sometimes consisting of only a sprinkling of houses and sometimes major districts having big market places, temples, holiday resorts and houses.*

*After reaching Kalpa and having a few cups of warm tea, we headed out for a short walk all the way accompanied by a vertical drop plunging 3000 feet down right till the rocky banks of the turbulent Sutlej on our left. The hike was full of menacing diversions - raging monstrous winds roaring through the valleys and chilling the bones, craggy rock faces of inexplicable eminence and deep stony gorges."*

Vinda David

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