Medabil Streamlines Geometric Design of WTorre Morumbi with BIM Advancements

Bentley’s Interoperable RAM Software Helps Reduce Design Time and Project Costs on Brazil Office Building

Structural Solutions for Uncommon Geometry

Medabil Sistemas Construtivos S.A. (Medabil) was contracted to develop the structural design for the WTorre Morumbi building, located in the fastest growing business region of São Paulo, Brazil. With two 38-floor towers interconnected by five steel bridges spanning up to 35 meters, the innovative design required two structural systems—one for horizontal stability and one to absorb the gravitational loads. Medabil implemented RAM, Bentley’s fully integrated application for the design of steel and concrete structures, to perform collaborative modeling, engineering, and analysis. The final design accommodated the geometry and positioning of the suspended walkways while providing safe solutions for stability and gravitational load support. Using RAM to optimize the materials for this hybrid structure reduced project costs by an estimated 50 percent.

WTorre Morumbi Challenge

Designed by the architects Affalò / Gasperini Arquitetos and constructed by WTorre Engenharia, the WTorre Morumbi building comprises 170,428 square meters of built area. The project’s goals were to develop a steel/composite structural solution that also optimized and standardized the structure, all while reducing lead time needed for the design, detailing, and erection. As a leader in the design, fabrication, and erection of steel structures in Brazil and overseas, Medabil had the expertise in innovative constructive solutions required to achieve these goals.

Medabil addressed several structural design challenges associated with the WTorre Morumbi building. Foremost was the uncommon geometry and positioning of the five suspended walkways, which exhibited independent behavior affected by wind pressure and the relative displacement between the towers, especially at the top of the building. The structural design team was also challenged to resolve how the reinforced concrete cores of each tower would ensure horizontal stability and delimit vertical movement.

Developing in an Integrated BIM Environment

Using RAM software, Medabil implemented a BIM methodology to develop the entire project. Numerous 3D models were created for the design of the steel walkways to determine the optimal structural solution for each individual walkway. Wind tunnel test data was input to the RAM model to refine the tower stabilization measures. The solution was to equip the interconnecting structures with special fixtures to provide support and anchoring, while allowing for compatible horizontal movement and common displacement between the towers. To hoist and mount the 60- to 150-ton walkways over 40 meters high within the spatial confines of the towers, Medabil employed a system that could lift, and then rotate each structure upon reaching its final position.

The multi-discipline project team used RAM to perform and validate calculations for both the metal and reinforced concrete components of the structural systems. The stabilization system in each tower relied upon the reinforced concrete core to provide lateral stability, and used composite beams, concrete columns, and steel deck slabs to provide gravitational load support. To optimize the construction schedule, Medabil used a temporary isolated metal frame during the assembly phase that rose up to six floors above the last level of concrete.

Fast Facts

- The ability to integrate the RAM structural model for calculation with the SRS/2 detailing software facilitated comparative studies and ensured an efficient, secure flow of information.
- Medabil demonstrated a differentiated and cost-effective approach in the design of the WTorre Morumbi, which provided 94,000 square meters of leasable area.
- Achieving LEED Silver certification drove decisions related to sustainability, such as choice and interventions on the plot, economy and rational use of water, choice and use of materials, internal air quality, and rational use of energy.

ROI

- Bentley’s collaborative, interoperable software enabled Medabil to reduce basic and detailed design work by 65 percent.
- RAM analysis optimized the use of materials, reducing weight by 15 percent and project costs by approximately 50 percent.
- A 45 percent reduction in engineering lead time for design and detailing helped to optimize the project work schedule.

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- Achieve maximum optimization of the structure and standardization of the design despite an uncommon geometry.

Products used:

- RAM
The concrete cores and periphery pillars were poured using high-strength concrete to ensure greater agility when erecting the metal structure.

Streamlined Design on Shared Platform

With the number of challenges Medabil faced on this project, it decided to reduce its risk by partnering with Thornton Tomasetti, a firm experienced in providing engineering design, investigation, and analysis services. Thornton Tomasetti used RAM to validate all of the designed structures, which included Medabil’s calculations for the steel structure, reinforced concrete, and lifting project for the interconnecting walkways.

Using RAM in an integrated BIM environment played a critical role in streamlining the modeling process and reaching cost-effective solutions for optimizing the structural design. RAM’s easy-to-use interface and agile review process enabled the project team to compare alternatives and select designs in record time. The software ensured a fast and secure flow of information, and incorporating international codes, stud criteria, and vibration checking ensured reliable solutions.

RAM Delivers Measurable ROI

Using RAM’s integrated software package enabled Medabil to ensure that each design element was employed in an economically justifiable way. Through this optimized structure, Medabil achieved the goal of demonstrating a differentiated, responsive, efficient, and cost-effective way to build the multi-floor building. The project yielded measurable savings in engineering design and detailing time, and in operating costs during construction.

During each structural model analysis, the team rationalized materials to optimize the overall value of the project, reducing weight by 15 percent and project costs by approximately 50 percent. Bentley’s integration with third-party products allowed Medabil to export the RAM model for structural calculation of the building into Design Data’s SDS/2 software for 3D steel detailing. This single process reduced basic and detailed design work by 65 percent. The resulting reduction in engineering lead time for design and detailing helped to optimize the project work schedule, thereby minimizing operating costs.

Cost and Time Savings

Given the complex building geometry of WTorre Morumbi, RAM’s integrated application suite was instrumental in streamlining new and unconventional structural solutions based on overall cost. The team relied on RAM to perform and validate calculations for the metal works and reinforced concrete, review and analyze solutions, and make quick and accurate comparative studies. Bentley’s collaborative engineering software enabled Medabil to develop an innovative, cost-effective solution for building multiple-floor buildings in Brazil.