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Tall Expectations

CW reviews best practices and gaps in India's skyscraper engineering scene.

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mechanical treatment process (TMT) like Fe500, Fe550 rebars having elongation more than 14.5 per cent would offer high yield strength and ductility, which play an important role in resisting seismic forces," agrees Satyajit Mhatre, Associate Technical Director, WSP India. "A higher grade of steel with a yield strength of 310 N/mm² is recommended for structural steel elements to carry heavy loads. This type of steel helps to reduce section sizes, fulfilling architectural and MEP requirements while decreasing the self-weight of members or the structure as a whole."

Ramakrishnan Sengeni, Head of Structures, Surbana Jurong



"The effectiveness of firefighting and rescue operations in tall buildings mainly depends on their internal fire safety system."

- Satyajit Mhatre, Associate Technical Director, WSP India

Group, cites a lack of seismic diaphragm design techniques developed for the Indian context, and progressive collapse design as examples of Indian code

prescriptions that aren't in line with international codes of practice like the American code.

Seismic detailing often follows minimum ductility requirements without accounting for soil-structure interaction, higher mode effects or P-delta influences in tall systems, observes Talsaniya. He recommends applying performance-based structural design frameworks for seismic zones – leveraging dynamic modal pushover analysis, capacity spectrum methods and base isolation where warranted.

Several major cities in India, such as Delhi and Ahmedabad, are in seismic zones IV and V, respectively, which can pose additional challenges in constructing tall buildings, adds Magazine.

Wind tunnel testing is another area impacted by dated code provisions.



"Without performance-based design skills, real engineering is not happening."

- Ramakrishnan Sengeni, Head of Structures, Surbana Jurong Group

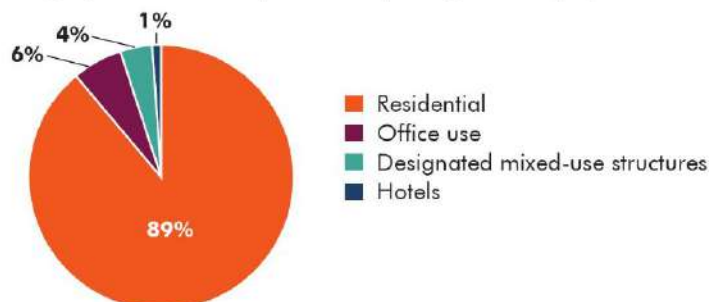
"Most tall buildings in India are designed using code-based static wind loads (as per IS 875 Part 3) rather than project-specific wind tunnel studies," points out Talsaniya. It is another matter that Sharma says "we rely heavily on foreign firms for wind tunnel testing."

Talsaniya recommends mandating wind tunnel testing for buildings taller than 100 m (as opposed to the current 150 m) and those having unconventional forms.

Sattva Image Tower, a 120-m

Why Are 89 Per Cent of India's Tall Buildings Residential?

- Nearly 89 per cent of India's tall buildings are residential, according to a CBRE report, and most are in Mumbai. Sailesh Mahimtura, Chairman & Managing Director, Mahimtura Consultants, explains this as being an outcome of a 'sea view' being a saleable factor for an apartment in that city. "It makes sense for developers to construct beyond 40 floors because at that level, you will have a sea view from all sides of the building," he says.
- Parking needs are also driving taller residential buildings. "Nowadays, it is less expensive to construct, say, eight podium levels for car parking than it is to construct basements," explains Mahimtura. "More so, it makes sense to construct taller buildings and provide more car parking above ground. At times, developers have to construct three basements and eight podium levels to provide car parking for their projects."



Source: CBRE report - Sky is the Limit: Rise of Tall Buildings in India

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- Kunal Talsaniya, Senior Associate, Ducon Consultants

(approximately 400 ft) tall building in Hyderabad's prestigious Hitech City, developed by the Sattva Group through a strategic collaboration with the Government of Telangana, adheres to advanced earthquake-resistant design methodologies that exceed IS 1893 standards for superior structural safety and seismic resilience. Cutting-edge computational modelling optimises the performance of the building against wind forces and aerodynamic pressures.

Talsaniya is of the opinion that municipal development control regulations also often conflict with modern tall building needs, especially in terms of parking, podium height, floor plate efficiency and fire zoning. Addressing this would mandate developing a harmonised regulatory framework that aligns IS codes, NBC 2016 and local regulations with international norms such as IBC, ASCE 7 and the CTBUH guidelines, while enabling flexibility through performance-based code waivers.

Or to quote Mahimtura: "We need more frequent revisions in the design code, say once every five years, not once every 15 years."

Regulatory alignment and faster approvals are vital to move the needle forward, adds Vinayak Bhosale, Chief Operating Officer, Rustomjee Group.

Integrated approach

India has come a long way in tall building design, but the next leap will come from integrated, future-ready

Restrictive engineering codes hinder tall building design and innovation.

Photo courtesy: Tanscom Developers

material usage and, though not significant, provide some increase in carpet area owing to reduction in sizes of columns and shear wall sizes in high-rise buildings, says Satyajit Mhatre, Associate Technical Director, WSP India. "Self-compacting concrete could also help achieve good quality concreting and strength in structural elements, which are congested with reinforcement."

Formwork gaps

Advanced formwork systems like slip formwork, self-climbing (or jump) formwork and Mivan aluminium shuttering systems facilitate a continuous, good quality finish and the rapid vertical construction of main structural system elements like core walls, shear walls and columns. However, advanced construction methods such as jump-form systems, slip forming, top-down construction, and high-rise precast cores remain limited to a few contractors, according to Talsaniya, which means many tall building projects progress slowly and quality is an issue, such that the structural integrity in high-tolerance environments is compromised. "Contractor capability can be enhanced by technology partnerships, enforcing modular detailing at the design stage and implementing real-time quality control

protocols using LiDAR (Light Detection and Ranging) scanning and drone-based progress tracking."

Vishnu Dutt Sharma, Founder & Director, Optimum Design, endorses the practical utility of reusable aluminium shuttering for faster construction with superior wall finish quality, based on his prior experience. While this has seen a rapid rise in adoption in the last decade, there is still scope for greater acceptance.

Material preferences

"Materials used to construct tall buildings should not only be fire-resistant and strong enough to weather external forces but also lightweight to minimise the load on the foundation," says Anshuman Magazine, Chairman & CEO - India, Southeast Asia, Middle East & Africa, CBRE.

Developers must keep Indian sensibilities in mind when choosing materials, adds Mahimtura. For instance, dry walls are popular in tall buildings overseas for helping to reduce the dead load and, therefore, lower the cost of construction, but Indian occupants are more conscious of wanting soundproof units, thus forcing the developer to use concrete block walls in high-rise buildings, he says.

fire rescuers equipped with hydraulic ladders can reach a maximum of 30 storeys, that is, 90 m from the ground level, which leaves a gap for rescue operations beyond the 30th-floor refuge areas.

Therefore, Mhatre points out that high-rise buildings must have their own fully functional internal fire safety systems, including smoke detectors, alarms, sprinkler systems and pressurised stairwells, and conduct regular mock drills to educate residents and ensure occupant safety during emergencies. Adopting materials that resist combustion and are designed to outperform the minimum criteria to withstand the fire (two to four hours) is desirable.

Essentially, the effectiveness of



"Offsite methodologies deliver factory-controlled quality assurance

that sets new industry standards."

- Shivam Agarwal, VP – Strategic Growth, Sattva Group

firefighting and rescue operations in tall buildings mainly depends on their internal fire safety system. Other vital factors, Mhatre says, are the availability of access roads and sufficient open space for the deployment of equipment and manoeuvring of fire tenders.

Fire safety preparedness, such as evacuation strategies, fire department accessibility, smoke movement and fire control, takes precedence in the construction of a tall building and developers must strictly adhere to these best practices during construction, adds Magazine. Besides, active control measures should include efficient emergency and evacuation plans with adequate exit points, fire alarm systems and sprinklers.

While the NBC 2016 and IS 2190 provide clear mandates for fire protection and egress, their real-world application is inconsistent, points out Talsaniya. "Refuge floor design, stair pressurisation, fire lift shafts and compartmentalisation often fall

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Vertical gardens, rainwater harvesting, clean air tech, and renewables are key to sustainable buildings.

rainwater harvesting, advanced air filtration systems and the use of renewable energy systems are some key features that developers should keep in mind to achieve sustainability goals."

Transcon Developers' Transcon Triumph and Auris Serenity at Mumbai aren't green-certified but nevertheless include 'green' features such as locally sourced materials, recycled materials, low-VOC finishes, sustainable timber, energy-efficient MEP systems, passive cooling design, high-performance glazing, rainwater harvesting, greywater recycling, efficient plumbing fixtures, green roofs, vertical gardens, robust waste management protocols to maximise

recycling and reduce landfill contributions, and landscaped areas to contribute to environmental and aesthetic value.

Standardisation goals

Standardising the structural member sizes, material grades, MEP systems, formwork, steelwork connections, and so on, helps speed up work, advises Kulkarni. "Structural transfers are best avoided or minimised because they take a significant time to design and construct."

Modular construction including DfMA is another route to standardisation and speedy construction, he adds. Overseas, this has been successfully implemented.

Factory-made modular products bring better quality control and thus lesser carbon. However, as such works need heavier cranes and investment in mass production, he says they have not yet become popular in India.

The Sattva Image Tower is India's first precast commercial tower. "We pioneered the industry's transition toward sophisticated offsite methodologies," says Shivam Agarwal, VP - Strategic Growth, Sattva Group. "Leveraging cutting-edge precast and composite steel systems fundamentally transforms material logistics. By producing components in meticulously controlled factory environments, we ensure unparalleled uniformity and precision, eliminating the variabilities inherent in traditional onsite construction. This approach delivers factory-controlled quality assurance that sets new industry standards."

The Siddha Group has embraced modular construction and precast components for Siddha Sky. Transcon Developers prioritises offsite manufacturing and modular construction for all its projects. "We incorporate prefabricated and modular elements to streamline construction timelines, ensure better quality control and reduce onsite waste across our sites," shares Kedia-Agarwal.

Possibly the expectations from tall buildings are taller than they are. As Bhosale says, "Tall buildings must do more than rise high – they must set new benchmarks for how cities grow: smart, sustainable and centred around the lives within them."

- CHARU BAHRI | CW |

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