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Addressing India's Local Concerns With A Sustainable Approach To Building Tall

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Sudhir Jambhekar

FXFOWLE INTERNATIONAL Senior Partner Sudhir Jambhekar is an architect and urban designer with nearly 40 years of experience on a wide variety of project types and scales. Sudhir's passion for design, art, and intellectual exchange with the next generation contributes a valued diversity to the design dialogue at FXFOWLE. Sudhir approaches design as a perceptive search for meaning and usefulness, narrowing the infinite possibilities for a project to an idea that balances the forces at work in each. His approach is rooted in the belief that all elements are part of the larger whole, and each element of the built environment is not only worthy of, but requires, design excellence. His major current projects include a 40-hectare masterplan of Dubai's Business Bay for Dubai Properties, a winning competition for a 301-meter tall mixed-use Park Hyatt hotel tower in Mumbai, and a 500-acre master-planning project on the Dubai Waterfront for Nakheel. He led the design of the award-winning competition entry for the Queens Museum of Art expansion, chosen as one of five finalists, as well as the firm's innovative entry for the new Perth Amboy High School competition, also a finalist. He was the lead designer for Manhattan's new Second Avenue Subway and designed several light rail stations in the New York area.

Peter Weingarten

In his role as a Partner at FXFOWLE INTERNATIONAL Peter Weingarten oversees all aspects of the firm's international projects and manages the day-to-day operation of the International Studio. In addition to directing individual projects, his studio responsibilities include business development and project management. He brings an energetic management style, passion for design, and environmental excellence to the firm. Peter is specifically directing many of the firm's international projects in the United Arab Emirates and India. Some notable projects include a series of mixed-use buildings for Dubai Properties within the Business Bay district of Dubai, which FXFOWLE master planned. These high performance buildings will be environmentally responsible and include building integrated photovoltaic panels, wind turbines and a living machine for wastewater treatment. He is also directing the team for a new 301-meter mixed-use, Park Hyatt hotel tower in Mumbai, India, which will be the tallest and greenest in the country when completed. This LEED Gold project is designed to minimize solar heat gains through a series of rotations in the building's form, provide on-site wastewater reclamation, and a solar chimney to generate electricity. For Nakheel Properties, Peter is concurrently developing the master planning and writing the sustainable guidelines for all future development of the new Madinat Al Arab at the Dubai waterfront, which will make this development the greenest eco-city in the world.

Addressing India's Local Concerns With A Sustainable Approach To Building Tall

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Abstract

In developing countries, places where builders are routinely confronted with challenges inherent to poor infrastructure, obstacles effecting constructability, and a lack of political will and state resources, the sustainable tall building provides a unique opportunity for economic analysis and social reflection. In India, especially, the social structure is defined by the economic structure. The impetus for innovation and for envisioning a new skyline is, therefore, both a reflection of the contemporary urban society and economy and a desire to alter that urban fabric. Design issues pertaining to function and program, as well as transparency and the building's exterior expression, become intrinsically a part of overarching concerns about the building's impact – symbolically, economically and environmentally – on the surrounding city. Using Mumbai's proposed new 60-story world-class hotel, retail and residential tower (India Tower) to illustrate the inherent variableness of building within a developing economy, the authors will argue that a truly sustainable approach to design acknowledges interdependence and embraces diversity in economics, necessitating that a successful "green" tall building be an integrated part of a society's financial, technological and cultural advancements.

Keywords: developing economies, sustainable design, high-rise development, India

Introduction

For India, the last decade is characterized by rapid growth in construction and development; the economy is experiencing 8% growth (Sud 2006). The port city of Mumbai, (Figure 1), located on the west coast and containing a deep natural harbor that handles over half of the country's cargo and passenger traffic, is assumed to have 20 to 24 million of India's estimated one billion strong population (16 % of the world's population). In addition to being one of the most populous cities in the world, Mumbai, formerly Bombay serves as the capital of the Indian state of Maharashtra and, consequently, exerts significant political and cultural influence throughout the country. Large-scale buildings, such as India Tower, which is currently under construction, can have a major impact on Indian society and can potentially affect labor and building practices. The Indian construction sector accounts for \$51 billion per year (Berger 2007) and employs 32 million workers [Construction Industry Development Council (CIDC) 2007]. Opportunities exist for inserting environmentally responsible design, practices and materials selection into the current global momentum for sustainability.

India Tower: An Overview

In June of 2007, construction started on India Tower, a 60-story (301 meters) hotel, retail and residential tower designed by FXFOWLE Architects of New York and Dubai. Located in South Mumbai, India, and developed by D B Hospitality Private Limited, India

Tower combines a high level of architectural design excellence, environmental responsibility, and high-end



Figure 1: Mumbai

shopping, dining and entertainment options to create a new destination for local residents and international business and leisure travelers. Designed to have the least possible impact on the environment, the tower will integrate current innovative sustainable systems and

technologies throughout the building – solar shading, natural ventilation, daylighting, rainwater harvesting, and green interior finishes and materials from local sources – to make it one of the greenest skyscrapers in India. The developer is also committed to making India Tower a Green Building Council LEED™ Gold-rated project, setting a high standard for future architecture and design projects in the country. The project team expects construction of the tower, potentially the tallest building in India, to be completed in 2010.

For FXFOWLE, a three-decade old practice based in New York City, their significant experience with the typology of tall buildings remained the common denominator between their work in Mumbai and projects in Asia, the Middle East and America. Initially, the firm saw their design solution as both a celebration of Mumbai's distinctive cultural influences and its current, ongoing transformation on the world economic stage. A more singular statement emerged from the design development process that had originated in an international design competition; the original, winning design scheme for India Tower came in later stages to reflect a complex exploration in tower design. (Figures 3 and 4)

Local influences, from the mixed-use program to the site's unusual and constrictive shape and its proximity to the water to the extreme weather conditions of the monsoon climate, eventually provided weight to the argument for a new scheme, one where the very nature of the tower's "tallness" and sustainability are a direct response to user requirements. Significantly, the layered programmatic organization (a vertical segregation of functions) has remained, for the most part, a constant in the India Tower design, while the exterior expression has evolved. Having entered into a lengthy and comprehensive process of identifying the most "appropriate" design elements – the best solutions for meeting user requirements and site constraints – the design team may only now be able to claim a real stake in Mumbai's future. This supports the argument that iconic architecture possesses authority only when the people recognize themselves within its formalized symbolism.

Challenges of Working in India

When measured according to today's requirements for supporting contemporary technologies, markets and population growth, India's infrastructure is grossly insufficient. The problem encompasses power generation and clean water supply, in addition to road and transportation infrastructure. The developer in India needs to consider a whole new category of concerns involving back-up generators that pollute and constructing new roads within an already stressed (nearing full capacity) transportation network – as well as the perpetuation of an automobile-centric society with its dependency on fossil fuels for energy. Challenges associated with inadequate infrastructure are also

indicative of the historical legacy of a rigid colonialist system; the system's original purpose, to support industrial development, appears to be at odds with constructability requirements associated with the mixed, global economy of the 21st century. Structural problems with the remnants of Mumbai's aging colonial era infrastructure, such as rail lines and other linkages (or lack of), are compounded by the systems' outdated technologies and inability to support the population's growing numbers.

State policy and law in India have encouraged the development of an open economy and, not surprisingly, an overwhelming reliance on the private sector to build infrastructure, roads, sewers and habitable housing. This is in direct contrast to the perhaps more familiar model of a town sprouting-up around a rail station, where infrastructure is built first, often by the state, and acts as a catalyst for private growth. In contrast, private and foreign investment and development in India are utilized as a mechanism for change in infrastructure management. The Department of Commerce allows for 100% foreign direct investment in the construction development sector, but the sale of undeveloped land is prohibited unless the investor provides infrastructure in those areas – i.e. roads, water supply, street lighting, drainage, sewage removal (DOC 2007).

International lending institutions, like the World Bank, have used their influence to mitigate the negative consequences of India's rather informally organized construction industry. In response to the persistent lack of a culture of safety in the workplace, often leading to outbreaks in disease, like asbestosis, silicosis and lead poisoning, lending practices by foreign investors and institutions increasingly require more transparency from the construction industry (CIDC 2007).

All of these measures and more mean that the developer in India is forced to examine their project's reach beyond the confines of the site's parameters – and the world community will most likely be present to take note of decisions made and actions taken. Despite all of these obstacles (and scrutiny), the development community remains optimistic, mostly because of ambition and having invested many years of hard work in the process, as well as a belief in the transformative power of a free society and economy.

Historical Context for Making a Statement

In India and other developing countries where the increase in high-rise development has progressed at a startling rate during the last decade, one may feel the need to ask, "Beyond the attraction of cheap labor and a real estate boom competitive with many European and American markets, why alter the skyline?"

At first glance, the motivating factors appear to diverge significantly from those that drove America's 20th

century love affair with the skyscraper. In New York City, in particular, the combination of being an economic and media capitol promulgated the development of the skyscraper as the ultimate signature billboard for any institution or corporation. The symbolic implications of India reaching skyward toward a better future fall to those with the means and political clout to effect such change. In contrast, in the United States, high-rise development is more often than not the product of personal, individual ambitions, the demands of a global and extremely diverse market place, and, increasingly out of necessity, the very pragmatic “green” solution for challenges associated with high-density programming, energy conservation and water performance. In India, the skyscraper is a means to secure and sustain economic and environmental health, rather than simply a statement about existing power.

There exist some similarities between the emergence of the New York City of the 19th and early 20th centuries and today’s Mumbai. Both cities are major ports, founded in commerce and trade. Both cities function as much more than centers of commerce; they are international hubs where ideas are exchanged and the premise for a free and diverse culture is confirmed every day. Mumbai, located off the west coast of Maharashtra, is the most populous city in India. As the commercial and entertainment capital of the country, Mumbai is an informal city that thrives due to its diverse population, commercial markets and culture. Originally comprised of seven islands, Mumbai’s mass is concentrated on a peninsula, with the southern most area forming the Central Business District (CBD). Like New York City, it supports a diverse population, a stock exchange that trades in the global market, and a large import/export industry, and contributes to the entire country’s success as a center for industrial manufacturing, as well as for the arts, fashion and theatre.

Perhaps the greatest parallel that the two cities share is their transformation from a developing economy to a world power and the subsequent role they played in forming an identity for their respective countries. Prior to the First World War, the United States was considered very much a developing country, one with over \$3 billion of debt. However, by the successful conclusion of the war, its economy had emerged with a \$3 billion surplus invested throughout the world – and, in the process, transforming the country from a debtor nation to a creditor nation and propelling New York City to the high status of any of the grand European cities of London, Paris and Rome. Mumbai, too, is emerging as the economic and cultural center of India, despite not being the official capital, and it is now demonstrating real influence on the world stage. Thanks in large part to the information and technology revolution and the spread of the global Internet, India continues to transform from a developing country into a country with economic security, with Mumbai serving as an anchor for future development.

The India Tower project, which is located in prestigious South Mumbai at the center point of the coastal Marine Drive (fondly referred to as the Queens necklace) and within ten minutes of the CBD, is particularly well sited for these same economic and cultural reasons. But, are these factors reason enough to strive for a similar skyline in Mumbai?

During the last century, the Bauhaus movement, Le Corbusier and even the Russian Constructivists could provide an architect with some direction for synthesizing converging ideas about architecture, technology and industrialization. Because these concerns now play out within a global marketplace, building tall continues to be about making a statement, in addition to developing innovative solutions for a client’s program. Especially within a developing economy where a convergence of outside factors – local economic conditions, climate, etc. – will prevent a building from being designed in complete isolation, the integration of technology and form, a Modernist principle and the impetus for much of the architectural advancements of the 20th century, becomes the basis for any formal concept. A sustainable approach is an acknowledgement of the inherent interdependence of the many stakeholders laying claim to a design’s development – and the resulting creative synergy of their contributions to the process.

The Large-scale Application of Sustainable Design

FXFOWLE’s experience building in New York City’s Times Square in the mid-1990s, a period when the neighborhood was still very much in transition, is illustrative of the potential reach of one project whose development was heavily influenced by the desire to transform an area of urban decay by utilizing sustainable design on a large-scale.

New Yorkers saw the construction of more than 15 new high-rises in Times Square during the past two decades. Guided by the Times Square Master Plan, the Interim Plan, and zoning and signage regulations developed by 42nd Street Development Corporation, this neighborhood was completely revitalized as a vital corporate community and a tourist destination. The Conde Nast Building at Four Times Square (designed by FXFOWLE Architects), (Figure 2), at the time, the first speculative office building in the city in ten years, served as the centerpiece of the 42nd Street Master Plan prepared by the 42nd Street Development Corporation, a public/private consortium created to promote the redevelopment of this traditional heart of Manhattan. In an economic climate where most were hesitant to engage in speculative development, the Durst Organization (the developer of the project) understood that this was the next key development area in New York City.

Initial meetings between the developer, architect and construction manager revealed a commitment on all sides to what was just beginning to be called sustainable design. That mutual belief in designing and building

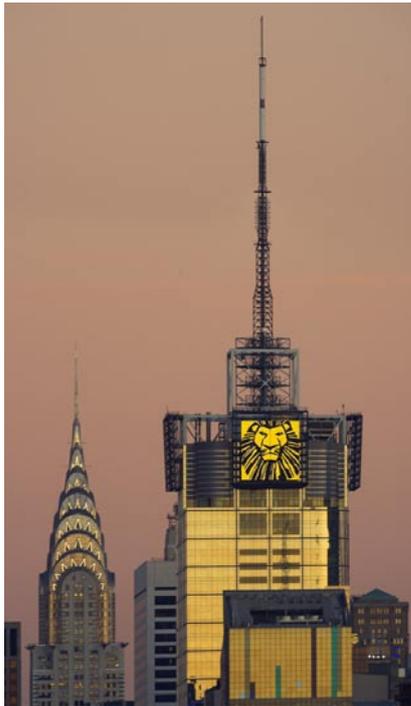


Figure 2: Conde Nast Building, designed by FXFOWLE

responsibly developed into a cornerstone for this project, which, in turn, became a benchmark for sustainable commercial development in America. The Conde Nast project set high standards for indoor environmental quality and energy efficiency, and, when it was designed in 1995, it was the first commercial project in the United States to integrate photovoltaic panels and fuel cells. This is important because of the environmental ramifications, and, even more significant, because of the project team's recognition that to build as before is simply not good enough; the effort needed to revitalize Times Square and, in the process, attain a higher level of development, one more meaningful and one that could demonstrate greater potential for a sustained change into the future.

Similarly, in India, private developers, like D B Hospitality Private Limited, weigh both the practical and iconic potential of exploiting the resource and space efficient aspects of high-density vertical development. Developers in India and in New York have the following in common: a desire to improve local conditions and to propagate a sense of upward mobility and the pride of having achieved something. As is the case in many developing economies, in Mumbai the idea that the status quo is not sufficient, nor is it sustainable, prevails. Embraced throughout society, a yearning exists to advance to the next level. This is the prerequisite for true growth and sustained development. So, significantly, the developer for India Tower argues that his project's transformative power includes the ability to spur more development around the site, in addition to building the infrastructure that will eventually support a network of interrelated industries, literally and figuratively transforming the Mumbai landscape. Project stakeholders

anticipate that the tower will have a significant impact on the look and economic viability of the area, evident at the street level, within 10-15 years.

In India, the skyscraper's role as an embodiment of power, in other words, the explicit tangible, or visible, expression of a state, company or individual's authority, takes on a different, yet equally powerful, symbolism. Here, architecture's formal statement inevitably grows out of the process of developing solutions to challenges presented by the environment, site and surrounding infrastructure. The desire to build a "destination place" – a mechanism for development that extends beyond the site's parameters – is indicative of demographic changes in India, as well. A third of the country's population lives in urban areas, and the growth of an affluent middle class has increased domestic tourism. The hotel industry is expected to expand as four million international tourists visit India each year. It is estimated that India must spend \$10 billion to produce 90,000 five-star hotel rooms to cope with the growth in tourism (Berger 2007). Consequently, at least in India, building tall also means building to accommodate a growing and increasingly mobile population.

The question then becomes how do you build tall, while identifying responsible, sustainable solutions for overarching concerns about the building's impact – symbolically, economically and environmentally – on the surrounding city. At what point in the design process does the tower's "concept" become about revitalization, long-term sustainability and a reflection of local conditions?

A Local Building that is also Iconic

For Mumbai, India Tower is the appropriate building for a specific place, time and people. To be the "right solution" for the specific challenges of an individual project carries its own poetics; there is a certain clarity and elegance in the argument that the design demonstrates the best practices of efficiency in the use of materials and resources, economy of scale, vertical transportation capacity, and structural response to vertical and horizontal forces. India Tower is also a local building that functions as a global indicator for the developing world. Because an individual developer was able to change institutionalized and codified perceptions (both entrenched within the municipal culture and formalized in law and policy) about the appropriateness of scale and the quality of the design and execution, the project possesses a snowball effect, serving as a catalyst for change in multiple arenas, including construction technology and general innovation in India and potentially throughout the developing world.

The key is to use design, as well as the inherent momentum that coincides with project stakeholders' ambition and drive to realize goals, to create a meaningful product that is also an integral part of the

larger urban fabric. Ideally, the project does not become just another disconnected, singular statement in the sea of competing egos that often characterize the landscape of many emerging cities that lack a master planning strategy. A holistic, sustainable approach to design is also an argument for setting a precedent, or corner stone, for what could eventually be a master strategy for building a healthy community. Similar to the way a well-designed, efficiently functioning building is composed of interdependent parts, a tower must also be a harmonious and congruous part of the larger organism, the city. The goal is a cohesive architectural concept that expresses the character and quality of an organization whose identity also reflects membership in a larger community. This means refraining from embellishing the design with elements that fail to use less, do more and relate better to their surroundings than their conventional counterparts – effectively, finding an *essential* expression, using proportion, light and materials. Emerging from the philosophical framework that eventually produced the design vision that will be India Tower is arguably the greater accomplishment in having achieved harmony between the client, user, site and community.



Figure 3: Competition Scheme for India Tower, designed by FXFOWLE

Transparency and Exterior Expression: What Face to Show the World?

Free societies and economies are destined to become a part of a larger global community where differences are narrowed and collective/shared beliefs become less distinct. As discussed, state policy and law in India have encouraged the development of an open economy and cultivated a culture where it is primarily the private sector that is expected to build infrastructure, roads, sewers and, in general, sustain the emerging economy. This is a tall order, especially when one considers the sense of ethical responsibility to help right economic and social inequities that developers, like D B

Hospitality Private Limited, often feel go hand in hand with large-scale development efforts. [55% of Mumbai's residents live in slums; the city plans to redevelop these areas primarily through public private partnerships (Wharton 2007).] When developers go outside India for help – to secure funding and technical expertise – questions are often raised about whether, or to what extent, the project will remain “Indian.”

What is within an architect's control: to celebrate, optimize or transform ideas about culture? India Tower's design is the product of a long process of responding to user requirements with creativity and innovation; the way the building will look is a direct result of allowing structural solutions to be expressed in the exterior shell. The initial scheme (Figure 3) is an external representation of experimentation in programmatic stacking; each function is expressed distinctly: hotel versus residential. Later schemes (Figure 4) presented a more uniform representation of “housing.” Although the floor plan remained essentially the same, emphasis shifted from creating numerous, distinct functions to cultivating a singular definition of housing: a sense of community where only select functions – mainly shared spaces, like the lobbies and sky gardens – were distinguished within the overall program.

The vertical stacking of India Tower's program (Figure 5) is emblematic of the social stacking of Indian society, but the overall composition of the building challenges this condition by providing a grand “mixing bowl” public space (i.e. the hotel lobby), atypically located at the center of the tower. (Upon entering the tower, the visitor has to journey to the building's center before taking a divergent, potentially more private and exclusive, route utilizing the designated elevators to specific suites and residences.) In addition, secondary social gathering spots in the form of garden floors are positioned between each of the various programmatic sections. As a design response, this strategy is particular important in terms of its social symbolism, because Mumbai is widely acknowledged as the hub of economic and cultural activity within India. The city perpetuates this persona precisely because of countrywide and global preconceptions about Mumbai as a place of opportunity and accomplishment – thanks in a large part to Bollywood and historical lore about the region. Millions of people of all nationalities, ethnicities and walks of life stream into Mumbai every day. In a city lacking a habitable, safe and clean public realm, hotels are where the public can (to a limited extent) interact; within this climate, hotels serve as *de facto* civic architecture.

Within the architectural community, the human body with its structural skeleton, central systems and skin is a familiar analogy for high-rise development and, in particular, sustainable design. Programmatic stacking is likened to the structural qualities of the human spine, and each program element – in isolation, rigid like the dense

bone of the vertebrae – is paradoxically able to be very flexible when the body’s individual components function



Figure 4: Final Scheme for India Tower, designed by FXFOWLE

in unison. In the way that the spinal chord connects the vertebrae, India Tower’s mixed-use program, a reflection of Mumbai’s multi-dimensional culture and economy, is interconnected by vertical transportation and communication systems. The tower’s sky gardens are likened here to the soft tissue that functions as a buffer between each of the vertebrae, allowing the spine to compress and elongate, for the gardens serve as a buffer space between adjacent programs positioned above and below them.

At this point in the discussion the analogy of the body fails, for “buffer” is incongruous with the goals of the India Tower project. Buffering implies easing the proximity of these socially stratified elements into something much broader than a common boundary or demising wall. In the case of India Tower, the “soft tissue” areas provide the necessary connection to the surrounding city that is not currently available in Mumbai’s urban fabric; they offer members of a culturally diverse and dynamic community a place to come together. In the current paradigm of Mumbai, the hotel (as a typology) takes on new layers of meaning, expanding its role as a transient space and a place for accommodating tourists; in Mumbai, hotels also function as respites for those (with the means) looking for a clean, safe place for social interaction.

High-Performance, High-Density Architecture

Developers (and architects) in India are working against deep cultural, institutionally codified assumptions regarding the appropriate and safe Floor Area Ratio for structures; the FAR in India is half that of the global average. The monsoon climate combined with the pressures of India’s immense population is largely to blame for apprehensions, as well as misconceptions, about the application of high density building strategies. (New York City’s 19th century tenements also come to mind, with their limited ventilation, natural light and general poor quality of life.) For the majority of India, discouraging high-rise development has resulted in a legacy of satellite cities and otherwise contributed to continuing suburban sprawl. Although Mumbai’s population is concentrated (albeit growing at a alarming rate) and, therefore, does not yet suffer from the propagation of satellite cities, municipal leaders still wrestle with severe challenges associated with overburdened infrastructure, transportation and utility systems.

It stands to reason that a technologically driven, sustainable architectural solution for high-rise development is the right solution for Mumbai, for this is the answer that is providing the most options for managing the negative impacts of uncontrolled population growth. In more ways than one, Mumbai’s skyline is a reflection of a series of technological solutions for building under very particular conditions; it is also illustrative of individuals responding to both the symptoms of a problematic situation and the root causes. Symptoms of overcrowding, such as sprawl, traffic congestions and higher energy prices, are effectively combated by building up and by increasing the density within these structures. When high-performance, high density building strategies are implemented well, the mass transit system, for example, is more effective, removing traffic from overcrowded streets and ensuring that less energy is used per capita.

Sustainable high-rise “micro-city” developments with municipal systems (separate from any city grid and contained within the tower and its property) are a response to systemic problems, or core issues, including overburdened or nonexistent infrastructure, transportation and utility systems.

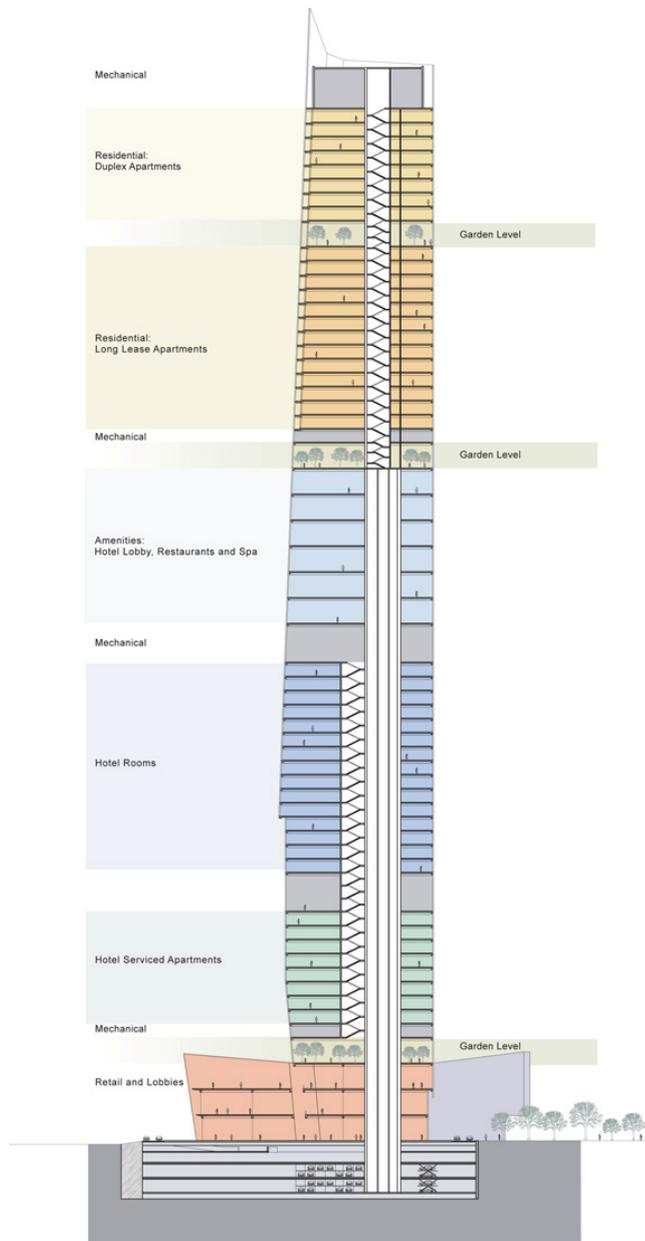


Figure 5: Section Diagram for India Tower, designed by FXFWOLE

If and when these developments can be connected, the result will be a distributed network of power generation and wastewater reclamation systems that will ease demands on Mumbai’s large-scale infrastructure improvement projects. Construction of these predominantly self-sufficient and sustainable “island” developments has already contributed to a renewed interest and increased investment in India’s cities. The

India Tower project, for instance, will be built in the oldest neighborhood in Mumbai, necessitating that improvements be made to existing building stock and infrastructure around the tower – including a natural gas distribution network to be used for on-site cogeneration within the building.

A Tall and Sustainable Future

Current development patterns continue to project a continuous migration to cities; sprawl, traffic congestions and higher energy prices only accentuate the desirability of urban living environments, whether one lives in New York City or Mumbai. Increased demand for urban residential housing and, specifically, high-rise residences is a strong indicator of the existence of a major demographic shift, as well as payback for having invested in real estate and smart growth principles. The issues that remain at the forefront of these trends are primarily focused on life-style and health choices – with indoor air quality, energy efficiency, and water conservation and reclamation leading the sustainable agenda.

In addition to it being the tallest structure, India Tower may likely be India’s greenest skyscraper. The energy efficient aspects of high-density vertical development are particularly attractive to India’s developers who are faced with increasing demand, with limited energy capacity. The leading sustainable measure for high-rise residential structures, though, involves indoor environmental quality and, specifically, the capacity of occupants to enjoy a high quality of life that is reliant upon the quality of the ventilation system. This is particularly challenging in a “hyperactive” commercial city, like Mumbai, with very poor air quality resulting from automotive, industrial and energy pollution. High-rise design must include strategies for proper ventilation and filtration of the outside air. (Although at exceptionally high elevations, natural ventilation may not be possible.)

India tower will incorporate integrated systems and technologies, setting a high standard for future high-performance, sustainable high-rise buildings in the country. Perhaps the biggest challenge for India Tower, though, is the balance between maintaining the necessary transparency – a project feature emblematic of the aspirations of its creators and appropriate for residential uses – and the need for proper and effective solar shading to reduce demand for cooling. High humidity is a challenge to maintaining an energy efficient and comfortable indoor environment. Specifying the latest in low-e coatings and minimizing the amount of glazing where possible, the project team ensured that India Tower’s “skin” will be fundamentally sound in terms of energy performance. The inclusion of a double wall in the current scheme will have multiple impacts, including delivering a “signature” look for the tower and providing shading and outdoor space for residents. The second skin will operate in concert with the inner skin to allow

for natural ventilation for those times when India's climate is more accommodating.

It is critical that measures such as these be implemented throughout the building industry, especially since India's energy resources are already strained and the demand can only be expected to increase. Consider that India's population is expected to grow at 1.3%, while the energy consumption rate is expected to grow at more than three times that rate, or 4.3%. Compounding the issue is the system's inherent inefficiency; India requires 2.88 times more energy than rich countries to produce the same amount of output (Srinivas 2007).

Water conservation and reclamation are a premium in Mumbai and many of the features of India Tower help reduce water consumption and provide for the recycling of water. Sky gardens and green roofs can help reduce the urban heat island effect. They are also effective vehicles for retaining water during most of the year, although the monsoon season can be intense, potentially overpowering any building's systems left unprotected by its façade. In conjunction with a complete onsite black water/sewage treatment plant, India Tower will have the capability of retaining and reusing a significant amount of stormwater. There is no shortage of water sources in a tower with this particular programmatic makeup, and every drop will be tracked. Treated water can also be used for cooling and for nonpotable uses, such as toilet flushing.

Conclusion

Developers and green advocates, alike, are coming to the conclusion that mixed-use, high-rise development is the best way to create neighborhoods that are socially sustainable and have a good quality of life. In India, the skyscraper often comes first, with the follow-up development at least a couple years behind, necessitating that synergy for a project is created now, not later. The optimal way to accomplish this is to create an economically diverse, interdependent community. In many ways, this approach is consistent with a general faith in sustainable design principles where the goal is to create a sustainable *environment*. A truly sustainable approach to design acknowledges interdependence and embraces diversity in economics. A successful "green" tall building is an integrated part of a society's financial, technological and cultural advancements.

A Final Note

FXFOWLE has long maintained that sustainable attributes are not separate from the rest of the process or product – and certainly not independent from local concerns about the site and neighborhood economy and culture. India Tower will use India's version of the LEED™ rating system to achieve a Gold rating, consistent with the country's recognition, in general, of

sustainability as a means for achieving economic objectives. Significantly, the move toward green is also pushing the high-rise residential building to the forefront of society's collective attention and imagination, awarding the typology with the same attention and inventiveness that high-rise commercial buildings have received in the past and, ultimately, changing the way building tall is done. The codification of these principles and practices, including the creation of the India Green Building Council and the adoption of LEED™ as the sanctioned metrics for evaluating a project, are representative of a national commitment to effecting a market transformation.

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