

Prepared for the CEO Council for Sustainable Urbanization

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21ST CENTURY BUILDING PROJECTS

Executive Summary

s part of China's ambitious urbanization agenda, China will be moving more than 10 million people a year through at least 2020 into the cities. A critical aspect of the strategy will be new infrastructure building to house these new urban residents, providing new places to work and retrofitting existing buildings. But buildings account for approximately 40% of the global greenhouse gas emissions and comprise the majority of materials deposited into our landfills. Promoting energy efficient technologies in buildings is a critical element in the struggle to limit pollution and mitigate global climate change. In addition to energy efficiency, buildings present an opportunity for scaling other sustainable practices (e.g., clean energy, water conservation and reuse, healthy living amenities.)

A key area of opportunity is sustainable, affordable housing. The Chinese leadership has prioritized affordable housing in the coming years with the recent announcement that they will begin construction of seven million apartments under the affordable housing program in 2015, according to the Ministry of Housing and Urban-Rural Development (MOHURD). And the Ministry of Finance and MOHURD have allocated 119.3 billion RMB (\$19.2 billion) for support of affordable housing programs in 2014, including public housing and slum development projects.

Innovative designs being piloted around the world represent the future of high quality, affordable, and sustainable housing. The following study focuses on three such projects:

• Via Verde: Located on a reclaimed brownfield site in the South Bronx, this 222-unit affordable housing complex achieved both LEED Gold certification for environmental responsibility. Championing sustainable building and healthy, affordable living strategies, Via Verde has won many awards including the Urban Land Institute's Global Award for Excellence, in 2013.

- Elephant & Castle: Located in a historic but marginal area of south London, the £1.5 billion Elephant & Castle is the United Kingdom's most significant redevelopment project of the 21st century. Replacing mostly run-down "council housing" with modern, sustainable residences, the regeneration is an example of public-private cooperation to achieve ambitious sustainable housing goals. It has also, however, been beset by protests and opposition claiming that the project is a vehicle for gentrification.
- Shubh Griha: The Tata Housing development at Boisar, India, is designed to provide workers with small, low-cost, sustainable housing in an environment that promotes healthy lifestyles, conserves energy, and offers a strong sense of community. The project was reverseengineered to determine first what the workers could afford, and then create a design to meet those price points.

According to the Ministry of Housing and Urban-Rural Development (MOHURD), the Government has allocated 119.3 billion RMB (\$19.2 billion) for construction of low-income housing in 2015, as part of its effort to bolster economic growth.

Individually, these projects offer unique approaches to sustainable housing, each designed and implemented to fit the distinctive challenges inherent in the circumstances and cultures. Collectively they offer a spectrum of sustainable housing efforts on three continents.



Via Verde housing project, the Bronx, NY, USA

Rebirth in the Bronx: the completed Via Verde project

The Challenge

Located in the South Bronx, one of the poorest, highest-crime and unhealthiest areas in New York City, Via Verde was a brownfield site on a 1.5 acre former railyard. The objective was to create a housing development that was not only affordable but also sustainable and conducive to more healthy lifestyles, and to help revive the surrounding area. The result would turn out to be one of the most lauded affordable, sustainable housing developments of the last decade.

The challenges were formidable. The South Bronx was home for many years to the poorest congressional district in the nation. The Bronx had suffered decades of neglect, urban decay, civil unrest and rising crime rates that by the 1970s made it an emblem of the ills of America's large cities.

Although various renewal programs were launched starting in the late 1980s, they failed to foster true economic rejuvenation. By the early 2000s, nearly one-third of residents still lived in poverty, and the Bronx trailed (and continues to trail) most U.S. cities in key indicators such as crime, poverty, public health, and education levels. The Via Verde site itself had seen little maintenance and no improvement since the closure of the New York Central and Hudson River Railroad Company's railyard in the early 1980s, and had become a center for squatting and illegal activity. The soil on the site was contaminated from the rail sidings. The City owned the site but had no firm plans to redevelop it, until a group of community and professional organizations and city agencies came together to create a unique coalition and build a unique project.

The Project

The Competition

In 2006 a competition sponsored by the sponsored by the city of New York Department of Housing Preservation and Development (HPD), the New York City chapter of the American Institute of Architects, the New York State Energy Research and Development Authority (NYSERDA), and Enterprise Community Partners was held for the redevelopment of the site. A part of the New Housing New York Legacy Project, it was the city's first juried design competition for affordable, sustainable housing. Calling for a mixed-income housing development of at least 150 units, the competition included the following criteria:

- An innovative design solution to the city's housing shortage;
- Homes that were affordable, sustainable, and would retain their value over time;
- A construction plan that would lower the lifetime costs of the buildings and their maintenance;
- An overall design that would not only conserve energy and resources, but would also promote healthy living in a desirable community setting.

Announced in 2007, the winning design was submitted by two developers—Jonathan Rose companies and the Phipps Houses Group, which is the largest non-profit developer of affordable housing in New York City—and two architects, Dattner Architects and Grimshaw Architects. While Dattner had for decades been active in creating affordable housing, Grimshaw, based in London, was a high-end design firm that had mostly built premium residences for affluent clients.

Community Responses

Once the winning design was selected, a special task force comprising high-level representatives from city agencies that would be involved in approving the project was assembled. At the same time the city established new green zoning regulations specifically designed to help projects like Via Verde win approval.

The next step was critical in ensuring that the project would have broad-based support from the local government and from the community. "The overall process was handled extremely well by the city," says Paul Freitag, one of the lead developers on the project with Jonathan Rose. "They sought out advice and buy-in from the start from the local South Bronx community board, and each of the five finalists was required to meet with local elected officials and get their input."

The local community board voiced its desires

for the project: It needed to have a strong component of public health, and to help provide access to high-quality food that wasn't available in the neighborhood. It also needed to combine affordable housing with units for sale at the market value of the surrounding area. All of these elements were incorporated into the final plan for Via Verde, helping to win strong support from local officials and business leaders.

Financing

Also key to the success of the project, the developers realized, would be innovative financing. In this the Bronx actually had an advantage because the city, as the owner of last resort thanks to tax foreclosures, could leverage the value of the land for new developments and help the developers with favorable terms.

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The first major challenge was finding a site for development. By the mid-2000s, finding a developable site, even in the South Bronx, was quite rare. "Very quickly the city volunteered this prime site to be the location of the eventual project," says Karen Kubey, who headed the selection committee for the project. "That's what gained the support of AIA (the American Institute of Architects). The first biggest hurdle was taken care of when the city said this is important, we're going to take a risk and provide this unique site for the competition."

The site was sold to the development team for \$1. Freed from the need to finance an expensive land purchase, the developers were able to concentrate their resources on optimizing the design for the features of the site. The total cost of the project was just under \$100 million, including nearly \$32 million for the co-op housing, which would include 71 townhomes designed for middle class homeowners, and \$67 million for the 151unit rental component, reserved for lowincome households. The project was financed through a combination of taxable bonds, lowincome housing tax credits, developer equity, and subsidies from local, state, and federal agencies. Via Verde cost around 10% more than a typical project of its nature and size, partly because of the green features built in but largely because of the remediation needed for the brownfield site. A formula based on the area median income (AMI) was used to calculate the prices of the units: the rental units were to be affordable for households making 40% 60% of AMI, and the co-op homes for households making 70% to 100%.





Human touch: designed for maximum light and efficiency

The Design

Via Verde includes a total of 222 residential units in a 20-story tower, two-level apartments, and two-level townhouses. The next challenge was the nature of the property itself: Faced with a narrow, tapering property, Dattner and Grimshaw's architects could not produce a standard rectangular block with apartments on either side of long corridors. "The site was certainly a challenge," says Kirsten Sibilia, a principal at Dattner. "Our design was inspired by these challenges and addressed them and the surrounding area with the a tendril-like form that wraps the site, hugging the perimeter and creating an central open space shared by all residents."

The property's most distinctive feature is the cascade of green roofs that step down from the high-rise to the mid-rise building, to the low-rise at the southern end. The positioning enables maximum exposure for the property's solar arrays, which provide enough electricity to light all the common areas. Outdoor, lighted staircases encourage residents to walk from the ground-level courtyard to several green roofs, including vegetable gardens, and a fitness center.

The facade is marked by a series of distinctive panels that provide shade, rain shelter, and a pleasing, varied appearance. Via Verde was one of the earliest projects in the United States to use these prefabricated panels, which deflect most rainwater and are backed by an inner insulating layer. The panels are part of prefabricated units that comprise windows, sunshades and balconies, in a single piece. Made of metal and cement, with wood panel accents, this sophisticated façade provides good insulation, yet is breathable. The use of prefabricated aluminum and cement throughout the project helped keep costs down and the environmental footprint of the construction small.

The units were designed to be open and airy, with ample sunlight and cross-ventilation. More than one-fifth of the construction material came from recycled material and the building features natural materials such as ceramic tile and bamboo flooring.

To save money and allow for design flexibility, the two lower elements employ a block-andplank structural system, while the 20-story tower is built from cast-in-place concrete.

Finally, Via Verde faced a challenge faced by many developers and architects trying to build innovative affordable housing: often, features and design elements and amenities found in the original plans are erased in the finished product, worn away by the pressure to make deadlines and reduce budgets. That didn't happen with Via Verde, partly because of the multi-agency collaboration and partly because the high visibility of the project brought an unusual degree of scrutiny. "In affordable housing the end product is usually not nearly as good as the competition entry," Kubey says. "In this case everyone was really on the line publicly to produce a building that was as good or better than what won."

Outcomes and Lessons

More than 30% more energy efficient than an average comparable property of its size, Via Verde earned a LEED Gold certification, the second-highest ranking from the U.S. Green Building Council. The on-site solar arrays and the open design help conserve energy, and the green roofs help dissipate heat and absorb rainwater while providing residents with natural spaces in which to play, exercise, and grow food.

The promotion of healthy living is among the property's most innovative accomplishments. The desire for a more healthy environment was made explicit in neighborhood residents' input before the buildings were designed. In that sense, Via Verde extends the notion of "sustainability" from environmental practices to include the health and lives of the people who occupy the buildings. "The design of the building is a critical part of the sustainability elements of the project because it manages to achieve a high level of density in a very accommodating, socially enriching way," says Katherine Swenson, the vice president for national design initiatives at Enterprise Community Partners. "Via Verde really shows that the health outcomes for residents are as important to sustainability as water and energy conservation."



Design Within Reach: Via Verde encourages walking and use of public transport

In addition to the community fitness center, Via Verde includes a 5,500-square-foot health clinic, operated by Montefiore Medical Center. Located in an area with little opportunity to buy healthful, affordable food, Via Verde has provided residents with additional choices; the rooftop gardens, for example, offer them the opportunity to grow their own food. The layout promotes walking, and regular fitness classes and seminars on healthy lifestyles are held onsite. The benefits of living in Via Verde for lowincome families will be measured in an HPD/ MacArthur Foundation study that will track health, educational performance, economic mobility, and other benchmarks.

By far the most important aspect of the Via Verde projectwas the strong commitment to enlisting and marshaling the support of the community, including residents, businesspeople, elected officials, and city agencies. Each phase of the project, from the design competition to the planning process through the construction and sales/leasing efforts, included deliberate efforts to gauge the will of the residents, harness the influence of local officials, and win the enthusiastic support of the community.

Via Verde's legacy in the affordable housing sector is wide-reaching, not only in New York, but also nationally. The changes initiated as part of the Via Verde development that have persisted in New York include

- RFPs that now often include weighted criteria;
- More open application procedures that bring in a broader range of developers and architects;
- More collaborative procedures among city agencies and private companies that begin at the project's conception and persist beyond the completion of the project;
- Little noticed design rule changes, such as allowing open kitchens.

"Some of these sound quite small," remarks Kubey, "but they changed the way the city works."



Green living: Via Verde residents can grow their own vegetables



Elephant & Castle Regeneration Project, London, UK

The big picture: A new, integrated approach to low-income living

The Challenge

While Via Verde presented a very specific set of challenges in a relatively small space, Elephant & Castle, in London, represents a challenge of an entirely different order. Comprising 19 acres in South London, Elephant & Castle is a historic district that, until its recent closure, included a pub that occupied the same space since the 17th century. The main feature of the neighborhood was the Heygate Estate, a group of concrete-block buildings where more than 3,000 people lived. Heygate Estate was a prime example of council housing, a subsidized residential development for lower- and middleincome people built by a local municipality, in this case the Southwark Council. It was also, for many, a symbol of the failure of such schemes, and the Elephant & Castle regeneration was unveiled with great fanfare as a new and innovative approach to remedying the ills of such decaying, depressing places.

The Council set out to find an answer to a pressing problem: how to provide affordable, sustainable, livable homes in London, which has become one of the most expensive residential real estate markets in the world. London's largest council landlord, with 54,000 council properties, Southwark has pledged to build 11,000 new council homes over the next three decades, with a focus on livability and environmental sustainability. Elephant & Castle is crown jewel of this massive undertaking.

At the same time, the project has been beset by protests and bitter arguments over the definition of "affordable housing" in 21st century London.With its outsized vision, its innovative approach to design and council living, and its vocal opposition, Elephant & Castle provides a fascinating view into the promise and the pitfalls of large-scale, sustainable urban redevelopment in the 21st century.

The Project

Planning and Development

In July 2007, after a competitive tender process, Southwark Council selected Lend Lease as the primary development partner. The launch of the plan, however, was delayed by the world financial crisis of 2008-2009. A redevelopment agreement was signed with Lend Lease in 2010, with the total cost of the full regeneration projected at £3 billion (\$4.65 billion).Work on the project began in 2012. The full Elephant &Castle regeneration comprises nearly 3,000 homes, grouped into three main properties:

- Elephant Part, a cluster of low- and middle-rise buildings that will replace the demolished Heygate Estate;
- Trafalgar Place, a 235-unit development of studio apartments and townhomes;
- One the Elephant, a 37-story tower with studio, one-, two-, and three-bedroom apartments.

The entire development was designed with an emphasis on energy conservation, carbon neutrality, and green materials. Elephant & Castle was one of the 14 founding projects in the Climate Positive Development Program, an urban redevelopment initiative headed by the C40 Cities Climate Leadership Group, in partnership with the Clinton Climate Initiative Cities Program and the U.S. Green Building Council. Under the roadmap submitted to this program, Lend Lease and Southwark Council have pledged that the full regeneration will be net carbon negative, by 2020.

Financing

The £1.5 billion cost of the regeneration is being borne by Southwark Council, Lend Lease, and other partners, with Lend Lease putting up half of that funding itself. The developer paid £50 million to Southwark for the Heygate Estates site—a price that many



Failed model: Faceless council estate

observers criticized as far too low for such a prime property in central London.

The Council was responsible for delivering a buildable site and infrastructure for the project, including demolition of the existing buildings. To help finance the redevelopment, Southwark set up an independent company that can borrow money from commercial lenders, with the loans to be repaid through rents. In this way the Council can act, through its proxy, as a housing association—i.e., a private, non-profit firm that finances and builds low-cost housing.

To fund the direct costs of constructing the buildings and marketing them, Lend Lease is building the project in phases, using the revenue from Phase 1 to finance Phase 2, and so on.

Overall, Southwark Council is completing a five-year program of major works totaling £500 million. The council's ability to generate income from large-scale redevelopment projects has enabled it to tackle a project on the scale of Elephant & Castle.

According to the Council, the regeneration will result in a net addition of several hundred affordable homes. That has become a point of contention, because the demolition of Heygate resulted in the loss of more than 1,000 social rented homes. The new district will include 1,650 homes classified as "affordable": 809 will have shared ownership, 212 will be available to rent at up to 50% of market rates, and another 629 at up to 40%.

It's clear that financing a redevelopment program at the scale and expense of Elephant & Castle required both creative, multi-source funding and contract terms that enabled the developer, Lend Lease, to make a profit. In the current real estate market in London, finding ways to build sustainable, affordable housing presents a huge challenge and requires compromises between the government, the councils, and private-sector developers that community activists often find unpalatable.

In regards to the low price paid for Heygate, it's worth noting that since the turn of the century

public subsidies for affordable housing projects have all but dried up in the United Kingdom, and the sale of decrepit propertiesat belowmarket prices is a common way of making projects viable for private developers who have an obligation to produce returns for their shareholders. The return for this concession is a commitment to build a certain percentage of affordable homes that deliver lower returns to the developer.

The Design

The principles of sustainability were integral to the design of the project. Contractors were required by Lend Lease to recycle 99% of the construction waste, rather than sending it to landfills. Onsite generators used during construction ran on either biodiesel or natural gas, rather than traditional diesel fuel. A portion of the construction jobs were directed toward ex-prisoners and other disadvantaged people from the district, thus helping to strengthen the neighborhood's fabric.

All of the buildings at Elephant & Castle use at least 30% less electricity and 40% less water than traditional buildings. One major design decision was to erect two-story concrete "podiums" that compose the first two floors of the building, topped by four stories built out of cross-laminated timber. The concrete platforms improved the water collection and the overall performance of the buildings, while the wooden upper floors provided abetterinsulated fabric for the homes. The buildings are oriented to maximize cross-ventilation and natural light, and many also incorporate green roofs.

Those elements added about 10% to the overall cost of materials and construction, according to Pascal Mittermaier, who was the managing director of Elephant & Castle from its inception through the fall of 2014. But the savings in terms of lower energy costs, better water attenuation, and efficient construction methods helped pay for those features. Such innovations "allowed us to package so much more green for the same overall amount," comments Mittermaier.



Shared space: The project is hoping to build a sense of community

Heat and power for the project were also designed with energy efficiency and sustainability in mind. Lend Lease funded the construction of a combined heat and power plant (which produces electricity and uses waste heat to supply homes with heated air and water) at Elephant & Castle, run on natural gas (which produces about half the carbon dioxide of burning coal). In addition, Lend Lease is helping to finance the creation of an offsite power plant, feeding into the London grid, run on renewable biofuels. Thus the buildings themselves use less energy than traditional construction, and most of the electricity supplied to those buildings comes from relatively clean or fully renewable sources.

The landscape design of the site was also created to produce a greener and more appealing city. The Heygate Estate was famed for its fortress-like, Corbusian design, which set it off from its surroundings and made outsiders reluctant to enter. Incorporating the largest inner-city park established in London in 70 years, the new Elephant & Castle is designed to be welcoming and integrated into its surroundings. Each home has 2 bicycle slots; automobile parking is strictly limited and costs extra.

The exterior design of the project, says Mittermaier, was inspired by the plane trees that for decades lined the streets and filled The exterior design of the project was inspired by the plane trees that for decades lined the streets and filled green spaces in London, providing shade and clear air.

> green spaces in London, providing shade and clear air. Demolition of the existing buildings was conducted in such a way to preserve the maximum number of trees, which form the heart of the new park—which in turn serves as the primary vehicle for dispersing storm water from the site. The project also includes London's first "bio-swales," which are essentially manmade drainage ditches with natural elements, such as reeds, to slow down and filter the runoff. Most of the rain that falls on the new Elephant & Castle winds up irrigating the park; no potable water is used to irrigate anything on the site. The trees should also help improve the quality of the air, which was among London's most polluted before the regeneration. "We didn't just focus on making it less bad," says Mittermaier, "but on restoring a deep connection with nature and using nature to reimagine what it could be to live in central London."

> The third goal, to make the project sustainable, livable, and affordable, was the hardest of all.



Roof work: Residents will be able to tend their gardens

Community Responses

From the start, responses to the Elephant & Castle regeneration, both positive and negative, have been vocal. Developers, council officials, and national politicians enthusiastically backed the plan, seeing an opportunity for urban renewal at a nearly unprecedented scale. Community activists, tenant groups, and preservationists adamantly opposed it.

The objections centered around three themes:

Preservationism: While there is little doubt that the neighborhoods composing the Elephant & Castle district needed revitalizing,the developers and supporters apparently paid little heed to the strong attachment many local residents had to the area as it stood. The closing of the Elephant & Castle pub, which had operated since the 17th century, for example, sparked outrage.

Affordability: Just what constitutes "affordability" is the subject of heated debate in the United Kingdom today. Supporters of the project point out that more than 1,600 of the nearly 3,000 new homes in the district will be classified as "affordable." Critics counter that that number is much smaller than the nearly 4,000 apartments in the former estates that were occupied by tenants paying heavily subsidized "social" rents.

Around 100 Heygate residents were offered what the developers considered full market value for their homes to relocate, but in many cases the amounts were too little to enable them to purchase homes in the new Elephant & Castle. At any rate it's clear that some residents will likely be priced out of the market.

Transparency: The third criticism of the project is that planning took place behind a veil of official opacity that prevented public input and comment. When plans for the regeneration were first made public in 2012, the outcry was immediate. An activist submitted a request for the data that backed up the planning application from Southwark

Council and Lend Lease—a request that led to a prolonged battle by the Council and the developer to keep the figures private. A series of community meetings organized by an outside communications firm did little to dispel the sense among many residents that they had little voice in the regeneration plan.

The courts have issued a series of decisions against the developers of Elephant & Castle and other major redevelopment projects in London, essentially forcing a reevaluation of the way in which such projects are conceived, planned, and carried out. Protests continue to plague the regeneration of Elephant & Castle today.

Outcomes and Lessons

Elephant & Castle is one the most ambitious sustainable housing projects ever undertaken, and, once completed, it could provide a model for such redevelopments in other major cities worldwide. At the same time, public opinion about the project remains colored by negative perceptions. More transparent engagement with local residents and affordable housing activists might have avoided some of the anger and vitriol that have ensued.

"It's clear that not all the same people will be returning [to Elephant & Castle]," acknowledges Mittermaier, who is now Global Managing Director, Cities, at The Nature Conservancy, "and public opposition remains a major challenge. But not everything is about affordable housing—big cities face a number of challenges, with the environment, with transportation, with access to green space. We've shown that you can address a number of them in a major project like this."



Multi-dimensional: The design is made for mixed-income living



Shubh Griha TATA Housing Project, Boisar, India

Honoring tradition: The buildings are designed to echo Gujarat styles

The Challenge

Located in the India state of Maharashtra, about 25 miles north of Mumbai. Boisar is an industrial area that has seen rapid growth in recent years as more than 1,500 businesses, particularly manufacturers, have established operations there. Among the companies that have built facilities near Boisar are Tata Steel, JSW Steel, BARC, Tarapur Power, drug manufacturer Lupin, and chemical company Ganesh Benzplast. Migrants have flocked into the area to seek jobs. With them have arrived the problems endemic to many fast-growing cities of India: sub-standard housing, slums, unsanitary conditions, environmental damage, crime, and a lack of educational opportunities for the children of workers.

Tata Housing, one of India's largest residential real estate developers, set out to change that with a project targeting "the bottom of the pyramid": the poor laborers and domestic servants that make up a large portion of the booming local population. Most of these people have no access to conventional sources of financing in order to purchase homes. Many of them live with other workers in cramped, crowded flats, separated from their families. Shubh Griha, the Tata Housing development at Boisar, is designed to provide these workers with small, low-cost, sustainable housing in an environment that promotes healthy lifestyles, conserves energy, and offers a strong sense of community.

India's economy is growing at 7%-8% a year and its population, about 1.25 billion, is expected to reach nearly one and threequarters billion in the next 20 years, making it the most populous country in the world. India is now the third-largest emitter of carbon dioxide in the world, behind China and the United States, and the country's emissions of greenhouse gases are projected to increase sharply as the country industrializes and its middle class expands. As workers migrate from rural villages to cities in search of employment, India is undergoing one of the most intensive periods of urbanization ever seen: According to the UN's 2007 World Population Prospects Report, by 2030 more than 40% of India's population will reside in cities, up from about 31% today. Three of the world's 20 largest cities-Mumbai, Kolkata, and Delhi-are located in India, and all are among the fastest growing urban areas in the world. Finding a

way to house all these new urban dwellers in places that are affordable, sustainable, and healthy is a major challenge.

The central government has initiated various schemes to provide affordable housing to migrant workers in India, but they have been largely ineffectual due to a combination of corruption, ineffective monitoring and enforcement, market speculation, and the lingering effects of the real estate crash of 2008-2009. Most large developers tend to avoid the low-income residential sector, where margins can be half of those at higher levels of the market. Tata Housing, a subsidiary of one of India's largest industrial conglomerates, the Tata Group, is one of the few developers that have targeted this segment of the market.

The company estimates that India faces a housing shortage of 24.7 million units—70% of these in the affordable housing sector.

"When we started looking at bottom of pyramid, we conducted quantitative and qualitative research to find what people at the bottom are looking for," says Rajeeb Dash, the head of marketing for Tata Housing. "What we found was that they not only want a clean, affordable place to live but a home where they can have a community, to live in not as an individual or an exclusive unit—looking to be part of a township, where they can reproduce to some extent the life they left behind in the village."

Essentially, Tata faced 2 large challenges: how to build a large, dense housing project that was both sustainable and profitable; and how to enable customers to afford the homes. Shubh Griha is a unique attempt to create a new form of low-income housing for India's booming urban population.

The Project

The Company

Tata Housing tackled the first challenge by essentially reverse-engineering the development and the financing of Shubh Griha: the company conducted research to find out what the laborers at Boisar could afford to pay in monthly rent, and then designed the entire project, including materials, construction, and marketing, to hit that price point.

"We started with the need," says Dash. "What can this group of customers afford, and will they be able to buy it? That's how we created the concept of the product, a one bedroom with kitchen, and we went with the concept to the customers as part of the township program. We said 'Now you are able to buy it, what price will you pay for it?""

First established in 1984, Tata Housing was revived in 2005 under the leadership of Brotin Banerjee, the managing director, who has become a forceful advocate of affordable housing and green building in India. Seeing an opportunity in India's low-end housing shortage, Banerjee developed a strategy of building apartments quickly and handing over the property upon completion, enabling the company to build multiple projects in a short period of time. All of Tata Housing's buildings comply with Indian Green Building Council guidelines, with targeted savings of energy (from 20%-30%) and water.

Rather than purchasing land outright, in an area where rapid growth was driving land prices upward, the company entered into revenuesharing agreements with local landowners.

The company's research showed that the apartments would be affordable at around Rs. 1,400 to Rs. 1,450 (\$21-\$22) per square foot, or as low as Rs 400,000 (\$6,000) for purchase—well below the price that would provide a suitable margin on a conventional development.Banerjee set out to devise ways in which the price of the units could be kept to that level, and still provide Tata Housing with a profit. The first areas he examined were land acquisition and marketing.



Small scale: Shubh Griha aims to recreate a village feel

Rather than purchasing land outright, in an area where rapid growth was driving land prices upward, the company entered into revenue-sharing agreements with local landowners: Tata would pay 10%-15% of the cost of land upfront, and the remainder would be paid out as a percentage of sales. In that way the company kept the cost of financing the project low.

Banerjee and his team also devised an unconventional marketing program for Shubh Griha. Typically, marketing costs equal about 3%-4% of overall costs, usually in the form of commissions for sales agents. In this case Tata Housing decided to count on the large pent-up demand for low-cost housing, eliminating the sales force and focusing on an ad campaign in local newspapers, in trains and railway stations, bus depots, and other public gathering areas. The State Bank of India helped to distribute application forms. The marketing worked: more than 8,000 people applied for the first 1,000 available units.

Financing

Tata Housing financed Shubh Griha itself, with no government subsidies, according to the company. But even with prices for homes so low, it was not clear that the low-income workers could secure financing in order to purchase their own homes. Many of these people have no bank accounts; most of them have never established credit records. "These guys, they don't have formal records or documents—either they own their own business, they are auto rickshaw drivers or hawkers, and they have no formal papers," says Dash. "That's why we tied up with an NBFC—a non-banking financial corporation, which helped them understand how to go about buying a home and started giving them loans."

Tata drew on India's rich tradition of microfinance by associating with the Micro Housing Finance Corporation, which was set up in 2008 to address the large population of Indians who toil in the "informal" economy and have no links to the formal banking sector. MHFC's policies are designed to limit speculation and avoid crippling loan fees: interest rates are capped at 14%, and buyers are required to move into the houses within three months of taking over possession.

Building a sustainable apartment block at these costs, however, was a challenge of a whole different magnitude.

The Design

Shubh Griha was designed by a team of international architects headed by the HOK firm. A leader in green design for more than a decade, HOK designed the world's first LEEDcertified airport terminal. One of the early design goals was to produce apartment buildings that had the feel of traditional Gujarat architecture (Boisar lies near the border of Gujarat state). That meant low, four-story buildings, shaded sidewalks, and shops and apartments that open directly onto the street. The buildings center around a series of open courtyards planted with trees, with walkways to connect them and encourage residents to walk.

One of the most important construction decisions was to build the apartment buildings out of reinforced concrete blocks, rather than bricks. Many buildings in India are constructed from bricks—it's estimated that more than 250 billion fired-clay bricks are made each year in more than 100,000 brick kilns, most of which burn wood and seriously damage the local environment while emitting large amounts of carbon into the atmosphere. Building loadbearing walls from reinforced concrete reduced the overall carbon footprint of the project while creating better-insulated homes that would stay cooler in Mumbai's hot summers. These were the first buildings in India constructed using this technology. Base 4, another of the architecture firms, provided training and workshops for construction workers using the concrete blocks. Total recycled material content in the project was 21.8%.

The use of concrete blocks also allowed the buildings to be prefabricated and assembled on-site—keeping costs low. The presence of nearby large steelworks and concrete plants allowed most of the construction material to be sourced locally. Overall, constructions costs were Rs650 – Rs 700 (\$9.80-\$10.55) per square foot. Making the buildings green at that cost level required a series of low-tech innovations.

The landscaping, for example, includes mango trees that provide shade plus revenue for the occupants. Some 90% of the rainwater that falls on Shubh Griha is captured and harvested via a series of gutters, spouts, and cisterns an important feature in a water-scarce region of India. Overall, the volume of water used for plumbing at Shubh Griha is 53.5% less than the baseline volume for a comparable project, according to a consultant's report filed with the Indian Green Building Council.

The buildings are oriented to take advantage of cross-ventilation, and all outdoor lighting on the property is powered by solar panels. Interior lighting is supplied by compact fluorescent bulbs. According to a report prepared by the environmental engineering firm EN3, the energy use for space cooling at Shubh Griha is 23.4% lower than that of a baseline building.

Perhaps the most notable feature of Shubh Griha is simply the small size of the units themselves: the smallest, known as "nano homes," are 228 square feet, and larger apartments range up to 465 square feet—still very compact.

To ensure a mix of income levels—and the possibility of employment—in the area, Shubh

Griha is situated adjacent to another Tata Housing development, New Haven, which has more costly homes targeted at middle class residents. The two developments have separate entrances, and many Shubh Griha residents work as domestic laborers, gardeners, and so on in New Haven.

"The project is more sustainable because all the segments of people live next to each other," says Dash. Together, Shubh Griha and New Haven compose "a township that coexists."

Outcomes and Lessons

While the green-building elements of Shubh Griha are hardly unique (solar outdoor lighting and rainwater harvesting, for example, are becoming almost standard features across the developing world), perhaps the signal lesson of the project is that it can be done: it is possible to build sustainable housing that can be afforded by some of the poorest people in one of the poorest nations on earth. "This is not a charity project," Tata Housing MD Brotin Banerjee has said, and it's clear that the company has led the way in seeking a market niche in a segment most builders have long ignored or avoided.

The Shubh Griha brand has been extended to other Tata Housing developments in India, demonstrating that the model is replicable in multiple settings.



Colors of home: Even the colors come from Gujarat traditions

Affordable, Sustainable Housing: Lessons for the Future

hile each of the projects described in these case studies is unique to the time and the place in which it's set, some themes and lessons are common to them all.

1. Involve the Community

The word "community" is used here in its broadest sense, to include local residents, government agencies, elected officials, the developer community, and so on. In the case of Via Verde, the involvement, input, and approval of all of the stakeholder groups helped ensure successful completion.

Elephant & Castle is in some ways a counterexample. Public opinion about the project remains colored by negative perceptions. Any project of this scale, involving sums of this magnitude, is bound to spark opposition and criticism. But a more transparent and inclusive public outreach program might have defusedsome of the angry resistance that has ensued.

These projects represent proof that ambitious, progressive residential developments that are both sustainable and affordable are possible in the 21st century.

> Shubh Griha, meanwhile, was nearly unique among large affordable housing projects in India in seeking out (and actually incorporating) the input of local residents before the design was completed. That effort resulted in some significant design alterations, such as the inclusion of shaded walkways and open courtyard space for vendors, and it has helped the project blend into its local environment in a way it otherwise might not have.

2. Design Adaptively

Many sustainable features of these three projects are common to most progressive housing design today: ample ventilation and natural light, the use of local materials when possible, the encouragement of street-level community activity, and so on. Each of these projects, however, was designed in such a way to adapt specifically to the local conditions.

Via Verde, for example, was specifically oriented to encourage the use of public transit and enable the residents to eat more healthily. ShubhGriha was designed to accommodate, and to take advantage of, the neighboring bird sanctuary as well as its higher priced sister project, New Haven. And the leaders of the Elephant & Castle took advantage of the creation of a citywide network of bicycle paths to incorporate healthy, environmentally friendly modes of transportation.

3. Expand the Concept of Sustainability

Traditionally the notion of sustainability has applied to the energy consumption and greenhouse gas production of the buildings themselves. Among the pioneering aspects of the three projects are that each, to some degree, expanded the definition of sustainability, to include: the environmental performance of the buildings, the lives and health of the residents and the ongoing viability of the overall project.

The developers and designers of Via Verde recognized that a sustainable housing project had to promote healthy lifestyles and constructive behaviors among the residents themselves. Similarly, the developers of Elephant & Castle have structured the project in such a way to avoid the fate of many large affordable urban housing projects that become isolated from the larger community. And Tata Housing, by making sure that ShubhGriha residents have employment opportunities, information on healthy living, and proximity the more affluent population of New Haven, have established a holistic approach that should help prevent it from falling into the ills that plague many of India's overpopulated slums.

4. Recognize the Possibilities

Finally, the most fundamental (and simplest) lesson of these projects is: It can be done. Until recently, it has often been assumed that affordable housing cannot be sustainable, and vice versa. These projects represent proof that ambitious, progressive residential developments that are both sustainable and affordable are possible in the 21st century.

They accomplish this feat in a variety of common ways:

- Building in low-tech, low-cost green features, such as rainwater capture for irrigation;
- The use of innovative materials to keep construction costs low and performance high;

- Giving the residents a stake in the sustainable features of the project;
- Crafting innovative financing structures;
- Making high density an advantage rather than a downside;
- Making the quality of life, the health outcomes, and the socioeconomic achievement of the local residents a paramount goal; and
- Thoughtfully integrating the goals and features of the development with the broader goals of the entire city.

All of these practices in combination can result in overall results that go beyond the sum of the parts. "I think first of all the lesson of projects like Via Verde is just the notion that we can do better," says Katherine Swenson, the head of national design initiatives for Enterprise Community Partners.



Designed for life: Real sustainability is about the environment and humanity

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