



## LINEAR DOMESTICITY THE HONG KONG SINGLE OCCUPANCY STRIP

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According to the World Health Organization, seventy percent of the global population will live in urban areas by the year 2050.<sup>1</sup> As new cities form and existing cities burgeon in size, state and city governments across the world will need to grapple with the repercussions of densification. As residential buildings account for most of a typical city's building stock, increased density will have a significant impact on the urban dwelling. Hong Kong's political and economic system, limited developable land, and population make it one of the most crowded urban environments in the world. Skyrocketing real estate prices fed by profit-driven developers and a deluge of investment and speculation in recent years have made it increasingly hard for many families and individuals in Hong Kong to afford an apartment. One report indicates that 'property price increases in Hong Kong are now accelerating again, despite the economy slowing [...] prices in Hong Kong have surged 73% (56% inflation-adjusted) over the past three years, propelled by very low interest rates and strong foreign demand'.<sup>2</sup> Much of the foreign demand for real estate in Hong Kong has come from investors in mainland China seeking a more stable market.

Restrictions on land sales in Hong Kong in recent years have aggravated housing problems by encouraging developers to offer smaller, more expensive units. 'When land prices fall, Hong Kong restricts new land sales. The overall effect is that Hong Kong's hard pressed citizens' homes get smaller and they become increasingly unhappy with their lives [...] A two-bedroom, 506-square-foot unit that would probably house a family of three (or one wealthy person) is offered at HK\$2896 per (so-called 'saleable') square foot, a total price of just under HK\$1.5 million', close to US\$2 million.<sup>3</sup>

*Figure 1 (facing page): The HK:SOS façade modules can be sequenced based on owner preferences. The resulting seemingly random façade pattern resembles a façade that has been individually changed by residents over time. Image courtesy of Carlow Architecture & Design Ltd.*

## URBAN OPORTUNISM

How have shrinking living spaces built to minimum standards shaped our domestic lives? In his book, *Hong Kong: Culture and the Politics of Disappearance*, Ackbar Abbas discusses residents' adaptations of their own domestic environments when confronted with hyper-density. Abbas writes, 'perhaps the most characteristic way of all of dealing with hyper-density is to transform the facades of anonymous apartment blocks by the construction of illegal and semilegal structures: balconies, indoor gardens, additional storage space, and so on'.<sup>4</sup> The result of these informal adaptations in Abbas's words provided design inspiration for idea for the form and for dwelling within the space of the façade in the HK:SOS project (Fig. 1). 'It is as if the flat surfaces of these anonymous buildings were now covered in pleats or folds, multiplying in volume and interest and providing a zone of mediation between outside and inside'.<sup>5</sup>

Hong Kong provides many examples of illegal and informal adaptations, including cage houses and 'bed space' apartments, rooftop dwellings, and illegal façade structures. Cage houses or bed space apartments occur in many older neighborhoods in Hong Kong. They are created when landlords illegally subdivide a single apartment into multiple sublets that lack proper light and air, are overcrowded, and are dangerous with respect to fire codes and egress requirements. Rooftop dwellings and illegal façade structures are ad hoc extensions of domestic space into unregulated territory. Generally they are constructed without building permits, are unsafe in typhoon winds, and are forbidden by building codes. Despite their illegal nature, these adaptations suggest that when left to their own devices, the residents of a hyper-dense city have the ability to redefine domestic space. To increase urban density while sensitively responding to the domestic demands of the underprivileged in society, architects and designers must consider how informal architecture fills an important gap in the built environment.

The Hong Kong Single Occupancy Strip (HK:SOS) project is a response to a growing housing crisis in Hong Kong, in which the domestic environ-

ments of the future are becoming more unaffordable and less habitable. In reaction to the increasing cost and shrinking size of Hong Kong housing units, the HK:SOS project explores the challenges and limitations of living in minimally sized spaces by producing a linear apartment for a single individual (Fig 2). By packing life's quotidian activities into an impossibly thin strip, the project pushes the design of a domestic environment to a spatial extreme.

The project was initially investigated by 'unfolding' a typical high-rise, Hong Kong apartment building into a linear array of rooms along the façade of the building. The result is a thickened strip of exterior and interior space that the project uses as a conceptual platform for design. The model revealed a thickened façade system where window projections, balconies, plumbing, and mechanical systems on the exterior were intimately related to furnishings, rooms, and programs on the interior (Fig. 3).

Spaces for living, dining, cooking, bathing, and sleeping are strung out in a linear array of micro-rooms. Domestic activities are pushed into projecting window volumes that position the occupant precariously between a residential interior and the city outside. Window units are sized and oriented in response to each domestic activity and are angled and inflected inward or outward to adjust for privacy or views. Room types can be sequenced differently on each floor according to the desires of the occupants. Units are stacked on top of each other to create a building that could be attached to the blank walls of an industrial or commercial building to take advantage of highly valuable, under-utilized space in the city.

Large, blank walls can be found in Hong Kong when a tall building and a short building share an adjacent party wall. This occurs frequently when neighboring buildings were built in different times in response to different building codes. Large, open walls are also found on many industrial and warehouse buildings that don't feature windows on some facades. The HK:SOS project could conceptually take advantage of these spaces by adding a layer of inhabitation. This practice would likely not be allowed in the current building practice of Hong Kong, but rather, looks



ahead to a future city where uninhabited spaces are too valuable to leave empty. Additionally, the project has the potential to work within an adapted version of air rights laws in the city, allowing building owners to add building mass in the air space of neighboring properties.

#### STANDARDIZATION, PRE-FABRICATION, AND MASS PRODUCTION

The movement away from handcrafted or one-off construction methods to factory-made or at least industrially standardized units is not new. The mass production of architectural elements and standardization of building components and techniques dates back to the early nineteenth century. However, as leading architects, developers and visionaries sought to adopt the standardized, production-line techniques of the Ford automobile factory in the twentieth century, variation and site-specificity was often reduced or completely lost. Mass production and standardization were looked upon by many modernists as solutions to bring architecture to the masses by embracing industrial production.

Throughout the twentieth century, in Hong Kong and around the world, the prefabrication of standardized architectural elements enabled builders, governments, and developers to increase the scale and pace of construction. This increase in construction efficiency was especially useful in times of need for social housing. During the influx of new residents from mainland China to Hong Kong in waves throughout the mid-twentieth century, new high-rise housing types were invented and built all over Hong Kong, Kowloon, and the New Territories. New social housing needed to be built rapidly to safely accommodate thousands of new residents. The housing produced was tall, dense, and standardized to accommodate as many residents as possible as quickly as possible (Fig. 4). As such, mass production in design and construction was espoused as standard practice

Figure 2 (facing page, top): This exploded axonometric drawing shows a Hong Kong Single Occupancy Strip unit with a linear sequence of inwardly and outwardly projecting volumes that contain domestic programs. The exterior surface is proposed to be made of glass fiber reinforced concrete, while the interior spaces are wrapped in a seamless, thermoformed solid surface material. Image courtesy of Carlow Architecture & Design Ltd.

Figure 3 (facing page, bottom): This conceptual drawing unfolds a typical Hong Kong tower floor plan into a linear array of living and circulation spaces. Image courtesy of Carlow Architecture & Design Ltd.



Figure 4 (top): Aerial view of the repetitive towers of the South Horizons housing estate on Ap Lei Chau Island in Hong Kong. Image courtesy of the author.

Figure 5 (bottom): A model of several stacked linear living strips attached to the empty party wall of an industrial or commercial building. Image courtesy of Carlow Architecture & Design Ltd.

in a reaction to a housing crisis. A philosophy of minimum standards was adopted to improve living conditions for thousands of refugees who had been living in squatter settlements throughout what was then a British colony. Thus, minimum standards for space, light, and air were integrated into the building codes of contemporary Hong Kong from the outset.

Despite being able to efficiently house citizens in times of rapid development, the overtly standardized model of design and construction has had a negative impact on many facets of the urban condition and environment of Hong Kong. Thin, standardized facades in sub-tropical climates are problematic. The relatively heavy reliance of inhabitants on air conditioning systems is due in part to the inability of façade systems to block solar radiation, and in part to the low potential for natural ventilation on existing building surfaces. The HK:SOS design investigates how current building codes regarding projecting features might be improved by allowing building envelopes to be more responsive to heat gain and solar exposure. One such example in the HK:SOS design is that the depth and angle of windows can be tuned to specific exposures and site conditions. While deep, angled windows have the capacity to provide shading to interior spaces, the project has not been driven by environmental modeling or performance testing. In sum, this project is a critique of standardization on several fronts, proposing reconfigurable and variable façade elements that can be fine-tuned to account for environmental performance and sequenced to provide more social or domestic performance for the user, and still meet criteria for economic performance through the efficient process of prefabrication.

#### FLEXIBLE LIVING THROUGH FLEXIBLE FORM

Due to its density, Hong Kong has a highly regulated building environment. A strict set of building regulations combined with extremely high land values together have a standardizing effect on a city. When developable land is scarce, developers are motivated to maximize the allowable livable area to increase profit. Complex building codes tend to favor the standardization of conforming plans rather than allow irregular or varied

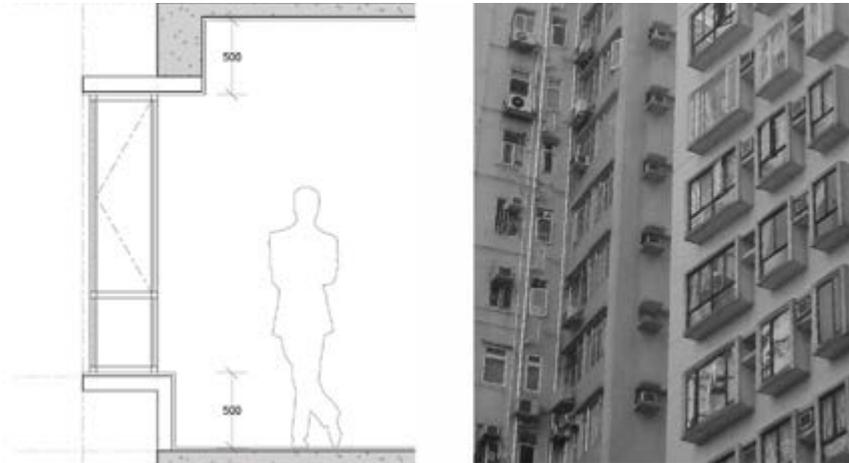


Figure 6 (top): Projecting windows are often found on residential towers in Hong Kong. Windows conforming to building code regulations are exempted from GFA calculations and offer bonus space to developers and residents. Image courtesy of Carlow Architecture & Design Ltd.

Figure 7 (bottom): Standardized, precast façade units in a concrete yard in the Pearl River Delta. Image courtesy of the author.

plans that risk non-conformance. Hong Kong's large scale, multi-towered housing estates are perfect examples of the repetition and standardization of floor plans and dwelling units from story to story and from tower to tower. Circulation cores, means of egress, unit orientation, and tower spacing are regularized and almost identical for the hundreds of thousands of residents in these estates across the city.

The HK:SOS project challenges the rote repetition of typical Hong Kong housing by allowing various living modules to be arranged in different ways. Theoretically, each floor could have different linear arrays or sequences of living, dining, working, and sleeping spaces. Flexible sequencing would project different modes of living spaces to the exterior of the building offering visual relief from other otherwise monotonously extruded forms of typical high-rise towers. As façade panels are prefabricated and clip onto a standardized frame, room sequences could be adjusted and customized floor by floor. Architects and project developers would have control over providing a variety of linear units to correspond to user design preferences and market forces. Inhabitants would be able to select units with arrangements of domestic activities that match their own personal living habits and desires. The resulting façade of a project with richly varied floor plates would begin to resemble the jumbled streetscapes and chaotic building elevations that Hong Kong has famously built over time, predating or subverting current building codes and instead accommodating user-driven preference and performance (Fig. 5).

## CODE LOOPHOLES

Traditionally, building codes have been written to ensure that people have enough light, air, and space within a living environment to lead safe and healthy lives. However, when developable land is limited and highly valued, as in the case of Hong Kong, minimum space regulations become the standard tool for shaping architecture. Designing for minimum ceiling heights, floor area, window sizes, distances between buildings, and other minimum requirements allows property developers to squeeze more units into a giv-

en parcel and subsequently decrease the standards of living for many city dwellers. Residents of Hong Kong are famous for their ability to live in small spaces for decades, though continued increases in real estate prices and shrinking apartment sizes has caused a great deal of political unrest.

An important element of the project was to identify, rethink—and at times, pervert—aspects of the highly restrictive local building code. One of the most identifiable characteristics of residential buildings in Hong Kong is the abundance of projecting bay windows (Fig. 6). These cellular protrusions are specifically outlined in building codes and are exempt from the Gross Floor Area (GFA) of a building. If they are built in accordance with the code, projected windows and balconies allow developers to increase the volume of a residential building without adding to the total GFA. Although they are granted as bonus space, the building code restricts their use. According to HKSAR Building (Planning) Regulations regarding the use of verandahs or balconies, ‘no such verandah or balcony shall be used or adapted to be used as a factory, workshop, storeroom, kitchen, lavatory, bathroom, water-closet, urinal or latrine.’<sup>6</sup> The HK:SOS project reverses this rule by inserting forbidden domestic activities into the projected spaces.

Beginning in the 1990s, the Hong Kong SAR Government promoted the use of prefabricated and factory-cast concrete construction to improve the overall quality of concrete work while reducing the amount of labor, construction waste, and adverse environmental impacts on construction sites (Fig. 7).<sup>7</sup> Later, beginning in 2001 and 2002, the HKSAR government offered GFA exemptions to encourage developers to use non-structural, precast elements to enhance ‘green practices’ and environmental sustainability within the construction industry. Since these incentives were legally established, construction in Hong Kong’s private sector has embraced prefabrication and precast elements.<sup>8</sup> While these guidelines are aimed at reducing waste and increasing efficiency, they do not incentivize architects or designers to find new possibilities for precast materials. The construction industry has adopted highly standardized versions of precast elements and has overlooked or ignored the potential to develop new modes of performance or alternative designs for modular façade units.

In the HK:SOS project, façade units themselves are designed to push the limits of non-standardized, customizable casting technology through the use of adjustable concrete formwork and molds. The project proposes the use of non-structural glass-fiber reinforced concrete (GRC) on the exterior skin. GRC can be sprayed into reconfigurable forms, which can be adjusted in terms of depth, size, and orientation. Façade modules and windows can be cast into a range of forms to complement a variety of interior activities. Shower units are vertically oriented and thin, while work surfaces and countertops are horizontally oriented. The overall unit can be oriented from side-to-side or up-and-down to respond to views, allow for privacy, or adjust to solar shading.

As each concrete module projects outward, interior surfaces project inward and are shaped according to the position of the human body in space. Thermoformed solid surfacing materials are proposed for interior cladding. Interior surfaces seamlessly integrate walls, countertops, storage, chairs, sinks, toilets, and bed platforms. As the majority of the HK:SOS project could be precast in a factory, a loophole is created, meaning that the GFA exemption could apply to more than half of the building.

## LIVING WITH DENSITY

The HK:SOS project approaches urban development in an opportunistic way. Faced with increasing land prices and limited housing supply, the HKSAR government has concentrated much of its effort in creating decentralized, new housing centers on the outskirts of the territory. Throughout the course of the late twentieth century, the government of Hong Kong planned and built New Towns in the northern New Territories with mass transportation hubs along train and subway lines. Instead of developing new, horizontal plots of land outside population centers, the HK:SOS project was designed to be inserted onto unoccupied, vertical surfaces of commercial or industrial buildings within existing urbanized areas.

The project reconsiders developers' typical approach to programming, massing, and the static conformity of typical housing in Hong Kong through a deeper understanding of the building code limitations, extreme economic conditions and the potentials of non-standardized production. The project attempts to build a critical argument toward repetitive building forms and envelopes that are examples of developers' attempts to maximize financial gain through thoughtless homogeneity. HK:SOS combines an understanding of past and current building codes with digital design tools that are deployed to yield more responsive and better integrated architectural prototypes.

As a design and research exercise, the project is productive in multiple ways. It has allowed the design team to explore new possibilities for living in a minimal space. A high level of spatial constraint forces an architect to consider the relationship between human habitation and a building envelope. The project also explores the ways in which advances in design and building technology could facilitate new possibilities for housing design, production, and assembly.

The project is also productive as a form of protest. While micro-apartments, cage homes, and compact living conditions are often celebrated and romanticized as precedents for good design, the project is intended to provoke the Hong Kong development community to reconsider the problems associated with living in hyper-dense cities. By bending the rules, HK:SOS suggests to the writers of building codes that they might learn valuable lessons from the informal and illegal strategies of residents in dense, urban environments. If density is inevitable, the project makes a case to the governmental and regulatory bodies of dense cities to ensure that adequate and affordable housing is provided to all citizens, without necessarily reaching the extreme conditions of linear domesticity.

## NOTES

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## ENDNOTES

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