VANKE® 万科®

建 筑 无 限 生 活

MIT

shenzhen_futures

DUSP PLANNING STUDIO: 11.306 Spring 2007

Studio Members

Shutsu Chai
Stephen Crim
Justin Fay
Kristen Hall
Kumar Kintala
Sophie Martin
Molly Mowery
Benjamin Solomon-Schwartz
Amy Stitely
Claudine Stuchell
Jase Wilson
Astrid Wood

Instructors

Tunney F. Lee
Liang Zhao
TA: Kai-yan Lee

Reviewers

Our thanks to their invaluable help and comments.

Lawrence Cheng
Antonio DiMambro
Randall Imai
Wu Jing
Deng Minqu

Sponsor: Vanke

Our thanks to the Vanke Group \Shenzhen Office. Their generous support, guidance and hospitality have made this project possible.

Wang Shi
Xie Dong
Xiao Nan
Zhu Jianping
Chen Xiaowei
Members of the Shenzhen office
Local architect reviewers

[CONTENTS]

Introduction 2

Bantian Connectivity 4

Building Diversity 46

Environmental Management and Education.....110

Tools 135

Land and Transit Planning 136

Building Community Facilities 151

Urban Village Regeneration 158

Mixed Use Development 166

Mixed Income Housing 172

Affordable Housing Financing 182

Inclusive Design 186

Designing for Density 193

Waste Management and Recycling 198

Stormwater Management 207

Community Education 215

INTRODUCTION

Liang Zhao & Tunney Lee

SUSTAINABLE RESIDENTIAL DEVELOPMENT IN SHENZHEN

Beginning in the Fall of 2005, MIT's Department of Urban Studies and Planning has offered a series of studios and research seminars on sustainable residential development with sponsorship from the Vanke Group. This report contains the work of the Spring 2007 Shenzhen Planning Studio.

The studio's goal is to start the process of formulating guidelines for developing a sustainable community in the future. In order to do this, the students were asked to search for design, financial, and management tools, which come from existing research and practice internationally. These tools were then tested in the exercise of re-planning Wonderland, a residential project in Shenzhen developed by Vanke from the late 1990's to the early 2000's.

This report has two parts: the first contains the site planning of Wonderland and second part contains individual research papers from the students on topics and tools relating to sustainable development.

SCENARIOS

"Scenarios are not predictions, forecasts or projections. Rather they are stories about the future with a logical plan and narrative.... Scenarios usually include images of the future – snapshots of the major features of interest at various points in time...."

–Gallopin

As a leading-edge developer, Vanke already develops projects in a careful and sound way in today's context. What the MIT studio can contribute is thinking into the future. Shenzhen is in rapid transition and will change economically, socially and culturally. Based on the study of Shenzhen's socio-economic trends, we first developed a series of scenarios for Shenzhen in the next 10 to 20 years.

No one can predict the future, but by observing what has happened in the rest of the world, we can make reasonable guesses about the direction of Shenzhen's growth and change. The purpose of the following scenarios is to provide a context and basis for the Studio's planning exercises.

Economy

* Pearl River Delta's economy will continue to grow less aggressively, e.g. 10% instead of 25% up to now.
* The economy will grow in a more balanced pattern between high-tech manufacturing, services, logistics, etc.
* Household income will continue to grow steadily.
* More equal distribution of incomes and municipal benefits – housing, schools, health care, etc.
* More integration w/ Hong Kong

Population

* From an immigration city to a more stable and normal population profile.
* Fewer single workers, more families and children.
* Less disparity in educational/cultural level.
* More active elderly.

Energy and Resource Use

* More national and local regulations on energy efficiency, water conservation, materials, recycling and waste disposal. Restrictions will be put on polluting sources.
* Higher energy costs will make alternative sources more economical.

Lifestyle

* Increased demand for mobility: commute, recreation, entertainment.
* Higher automobile ownership
* Extended families are still important but elderly will become more independent to their children.

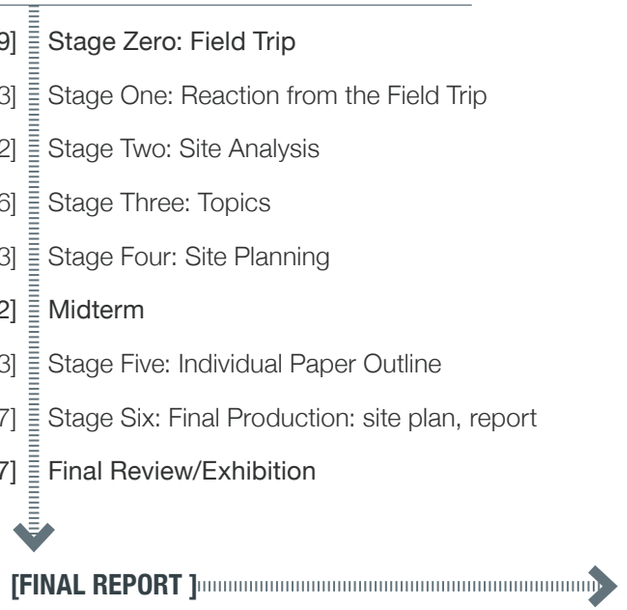
Transportation Planning

* Increased auto ownership and use along with increased truck and cargo volumes will create bigger problems of congestion and air quality.
* Public transit system continues development.
* The government will control auto use through congestion pricing, shared auto, parking, etc.
* Incentives for transit use through more convenient and comfortable transit and easier access to stations.

Land Planning

* Integration of land use/ transportation/ planning.
* District planning to accommodate mixed income groups with access to transit and open space networks.
* Land disposition procedures will be more regulated and based on district plans.
* Need for redevelopment of areas/structures reaching obsolescence.

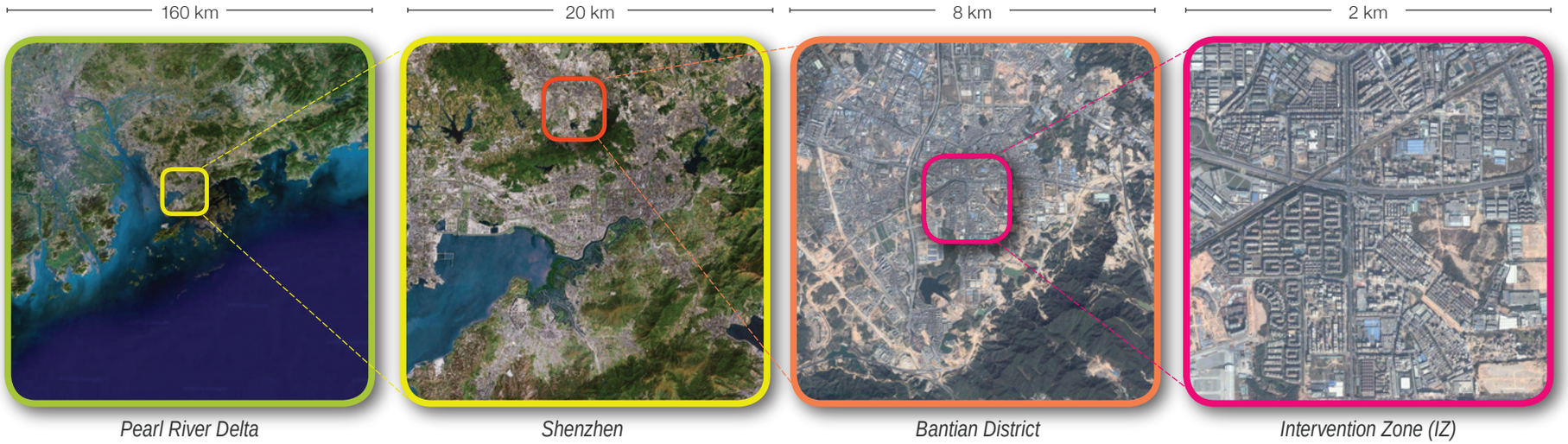
[STUDIO TIMELINE]



Stephen Johnson Crim
Kumar Kintala
Benjamin Solomon-Schwartz
Jase Wilson
Astrid Wood

BANTIAN CONNECTIVITY

An exploration into community building & accessibility in the district area around Wonderland.



SCENARIO

Scenarios & Assumptions for the Area

Introduction

Since the early 1980s the city of Shenzhen has grown rapidly. The population grew from approximately 30,000 in 1981 (Tian 2004) to 11.8 million people in 2004 (Guangdong Statistical Yearbook 2005). In order to accommodate this population, the local government has invested in numerous roads and a heavy-rail subway system.

Despite this growth, what does the future hold for Shenzhen's people and their ability to move around the dynamic city and region that they call home? This proposal provides strategies that will give Shenzhen's future citizens the access they need to the spaces and activities that form their lives. In order to propose strategies for Shenzhen's future development, it is necessary to enumerate the conditions Shenzhen will facing in another twenty years, around 2030.

Governance Assumptions

* ***The governmental structure of Shenzhen and China will remain more-or-less the same.*** The national, provincial, and municipal leaders in Beijing, Guangdong, and Shenzhen will continue to hold power through a one-party state with, perhaps, some space for local democracy and responsiveness to citizen concerns.

* ***Hong Kong will continue to be governed under the "One China Two Systems" policy.*** However, a narrowing quality-of-life gap and growing economic interdependence between Hong Kong and the rest of the Pearl River Delta (PRD) will allow a freer flow of people between the Hong Kong, Shenzhen, and the rest of Guangdong Province.

Demographics Assumptions

* ***Shenzhen's population will continue to grow to about 19 million people.*** Disparities in living conditions between city and country will continue to drive individuals to China's major urban centers in their search for economic improvement. The government will make investments to expand the export potential of the Pearl River Delta. Examples include the new Yantian port, which is intended to be the globe's largest container hub.

* ***Shenzhen will continue to evolve as the PRD's front-office center, the node from which the PRD's manufacturing and export activity is directed.*** This will continue to draw high-income, educated professionals and, possibly, a larger foreign population involved in joint-venture projects.

* ***Endogenous population growth will come as more of Shenzhen's residents elect to stay in the city and raise families, rather than treating the city as a transient center for work.***

Transportation Assumptions

* ***With increased population and economic growth, there will be increased trips for work to and from the Futian/Louhu central business district, as well as to other parts of the city and the Delta.***

* ***Increased affluence will also mean increased demand for leisure-driven movement.*** In spite of China's traditionally high-rate of saving and long working hours, Shenzhen's residents will shift more of their income and time towards consumption and leisure. They will demand shopping, entertainment, sport, and opportunities to escape the urban environment for natural surroundings, both in city-center parks and in the natural land outside the urban edge.

* ***Shenzhen's already high rate of automobile ownership will continue to grow.*** Chinese citizens are currently turning to private automobiles as the answer to their transportation needs, making China the second-largest automobile market behind the United States (Liu 2006), and the Chinese government has set out to construct a national highway system longer than the United States' by 2035 (Conover 2006). Shenzhen already has the highest rate of car ownership in China —in 2002 there were 18.5 cars for every 100 households compared to 1.14 for the nation as a whole ("Shenzen Leads Nation" 2002). Car ownership will continue to grow as the city's residents grow richer and as the central government continues to promote the automobile industry as a key economic sector.

* ***It will be a challenge to coax China's people will out of automobile-based transportation, as they associate automobiles with freedom, modernity, and material success.***

* ***The central and municipal governments will implement policies to control the negative externalities of automobile use.*** Beijing will impose stricter standards on automobile emissions, and the local government of Shenzhen will impose use restrictions to reduce pollution and congestion within the city. Congestion pricing and parking restrictions will apply in the central areas of Louhu and Futian.

* ***The city will continue to invest in public transportation infrastructure in order to encourage transit use.*** Investments will include expanding the current metro network and introducing other transit options such as bus rapid transit (BRT). For the purposes of our proposals, we assume that the government will carry out the capital investments currently planned for all forms of transit as laid out in the 2010 comprehensive transportation plan.

* ***The future planners of Shenzhen will need to work with kilometers of "legacy" infrastructure.*** In 2004, Shenzhen had 72.16 square kilometers of roadway, a majority of which will still be present in 2030 because of the high cost of removing such infrastructure. Changes to the form of Shenzhen will require working creatively with this existing infrastructure.

Longhua District

Vanke's Wonderland project and our area of specific inquiry are situated within what Shenzhen's city planners have dubbed Longhua Town (though it incorporates land that is technically part of Buji Township and it straddles both Bao'An and Longgang Counties). Over the next

20 years, the Longhua area will grow into a major sub-center for commercial activity in Shenzhen.

* ***The area will be home to over 1 million people by 2030.***

* ***The Longhua area will become a major commercial sub center for the city.*** It is already home to the headquarters of Huawei Technologies and major operations for Foxconn Technology Group, two multinational producers of consumer electronics. The city will guide similar low-polluting, high-tech manufacturing into the Longhua area, as well as white-collar commerce and service activities that are best sited outside the high-rent areas of Louhu and Futian.

* ***The government with build a planned inter-modal transit station hub along the western edge of Longhua.*** This station will help cement the area's prominence within the city. It will bring together three public-transport alignments: the number four subway line, which will connect Longhua to Futian; the number five commuter rail line, which will run through Longhua connecting the Shekou district in the west to Yantian in the East; and a new, high-speed rail connection between Hong Kong and Guangzhou.

* ***There will be increased pressure for redevelopment.*** As the area grows in prominence, there will be increased pressure from developers and the government to redevelop village-owned land and create high-income residential developments like Vanke's Wonderland. The district will grow more affluent and current income disparities will be reduced.

Bantian

At the smallest scale, this proposal focuses on an area that immediately abuts the proposed Bantian stop on the number five commuter line. While the location of the stop is currently planned for the current Bantian Railway Station site, relocating the site would better serve the needs of the district. This proposal assumes the station will be locatd on the triangular piece of land bounded to the south by Bulong Lu, to the East by Wu He Lu, and to the north by the current alignment of the Pingnan Railway.

REFERENCES
"Shenzhen Leads Nation in Car Penetration." People's Daily. 2 August 2002. English. people.com.cn/200208/02/eng20020802_100799.shtml. Accessed 23 April 2007.

GOALS

This proposal aims to raise the quality of life in the Longhua area of Shenzhen through creating high levels of access for residents of Shenzhen to all types of destinations. Reductions in travel times, additional community facilities, increases in social connections, and increased environmental quality will contribute to a rising quality of life.

Several goals animate this proposal:

[GOAL 1]
Improved public domain.
Integrate streets and upgrade their physical quality to provide a network of spaces that weaves together neighborhoods and destination places. Incorporate green features.

[GOAL 2]
More non-motorized travel.
Encourage the people of Shenzhen to walk or bicycle as much as possible through new patterns of land use and an upgraded pedestrian environment. By 2030, 20% of all trips in Shenzhen should be completed without motorized transport.

[GOAL 3]
More public transit use.
Additional facilities will increase the quality of life of all area residents and forge greater networks of connections between people living in different neighborhoods of Shenzhen. The facilities will include indoor recreational establishments, cultural facilities, and open spaces.

[GOAL 4]
Provide more quality space for leisure and communal activity. Additional facilities will increase the quality of life of all area residents and forge greater networks of connections between people living in different neighborhoods of Shenzhen. The facilities will include indoor recreational establishments, cultural facilities, and open spaces.

EXISTING CONDITIONS

{ REGION DISTRICT INTERVENTION ZONE }

Region Existing Conditions

Vanke's Wonderland development is outside the Special Economic Zone, near the border between Bao'An and Longgang counties in Bantian town, in an area termed Longhua. Longhua is located to the north of the core of the rapidly-growing Shenzhen region, itself adjacent to the Hong Kong Special Administrative Region. At present, the residents of Wonderland enjoy a relatively low-density environment (in the Chinese context) with convenient access to the major centers of Shenzhen. Highways provide easy access by car or bus to other locations. The new Futian government and commercial district is a five minute drive south. The Luohu border crossing to Hong Kong is a 20-minute drive. The Shenzhen International Airport is 40 minutes from Wonderland.

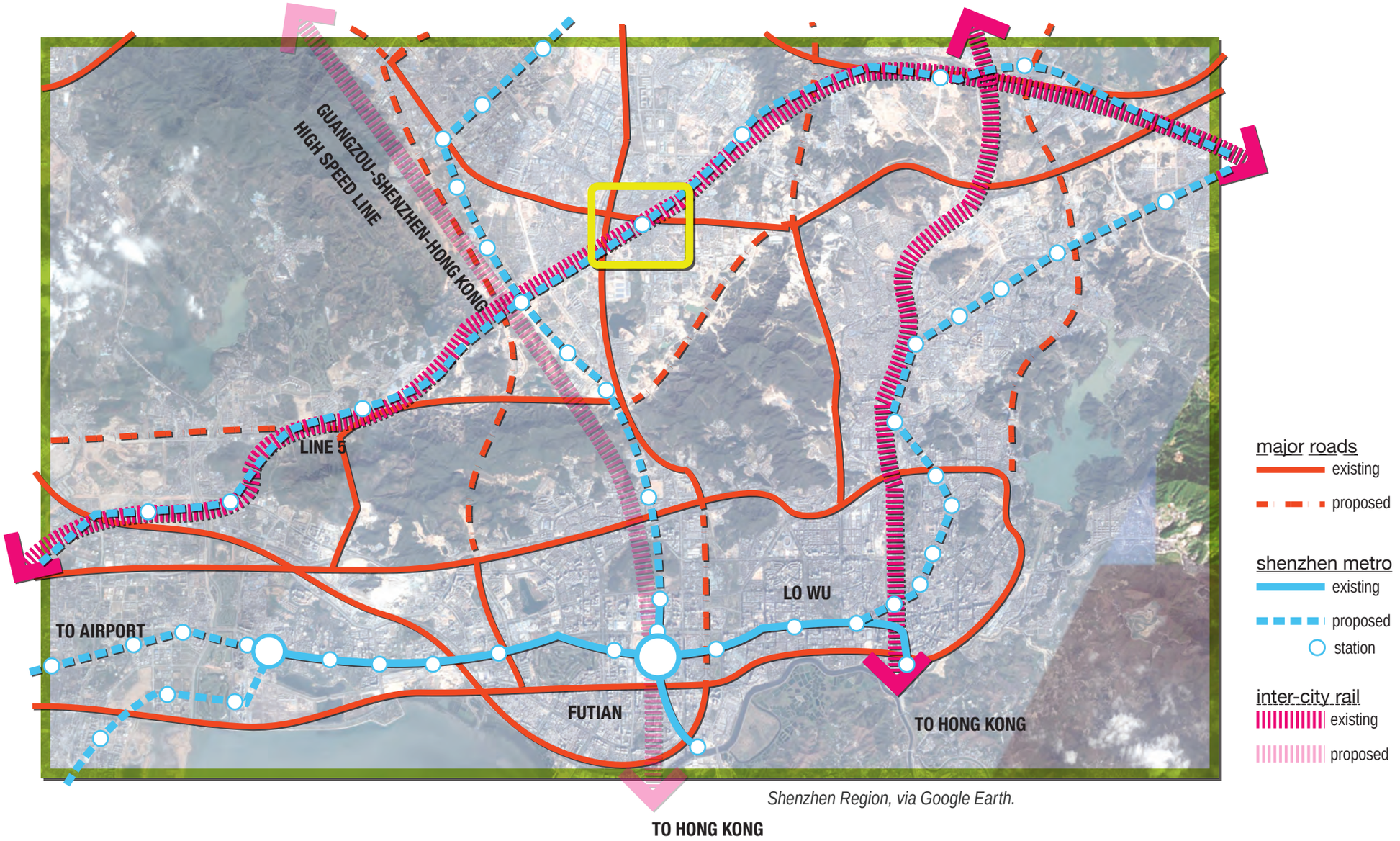
These travel patterns, which provide access to work and leisure for Longhua's upwardly-mobile residents, will be unsustainable as traffic continues to worsen. Despite rapid road building, congestion is outstripping new construction; in 2004, 40% of the city center's highways carried traffic below 20 km/hr during the evening rush hour, a 60% deterioration from 1999 (Shenzhen Planning Bureau 2005).

Shenzhen has also begun investing in public transport systems and curbing road congestion. These policies would increase transportation choices and regional connections. The current two-line metro system with 18 stations is being expanded to four lines with approximately 85 stations (Shenzhen Planning Bureau 2005). City officials are also planning transit initiatives like bus-rapid-transit lines ("Work Starts" 2007).

Although a stop along the Guangshen railroad is adjacent to Wonderland, the pattern of development does not provide easy connections to this facility. Direct access from Wonderland requires a steep and unpleasant crossing, which few people attempt. Future developments must be oriented around connecting passengers to transit.

In addition to rail investment, coordinated land use planning is necessary to improve the conditions in the Bantian area described here, including the connections to other areas of Shenzhen.

Source: Shenzhen Planning Bureau. Shenzhen Comprehensive Transportation Plan. Nov.2005. http://www.szplan.gov.cn/main/csgh/zxgh/ztjtgh/index.htm



Shenzhen Region, via Google Earth.


INTERVENTION ZONE
BANTIAN DISTRICT

EXISTING CONDITIONS

{ REGION DISTRICT ***INTERVENTION ZONE*** }

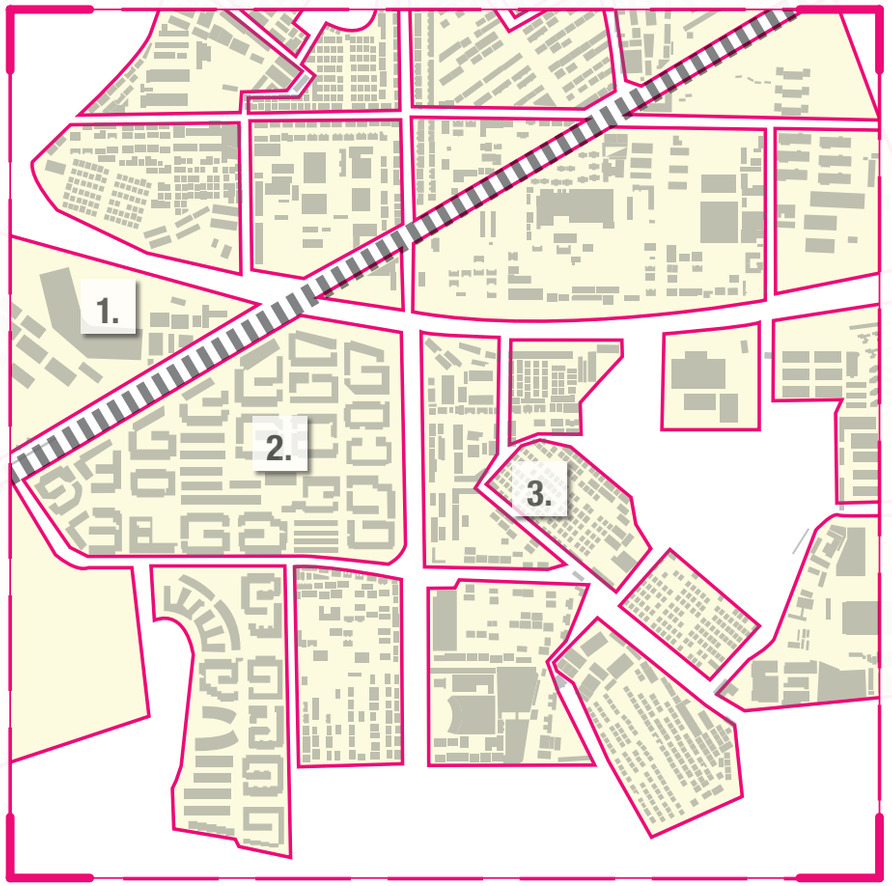


Figure / Ground + Neighborhoods

Several distinct types of development co-exist in the Intervention Zone: existing villages, new residential development, and patches of scattered commercial development. The existing villages show a fine grain of development with many small apartment buildings located in a small area. The new residential development displays a high degree of order, with a rougher grain of development than the villages. Finally, the scattered development includes buildings of various sizes interspersed with each other; together this scattering includes residential and industrial uses.

There is little coherence to the overall pattern of development across the zone. Most adjacent neighborhoods do not relate to each other, and there are few connections across neighborhood boundaries. Visual and physical barriers often separate one neighborhood from another, leaving each neighborhood an independent island within the greater district.

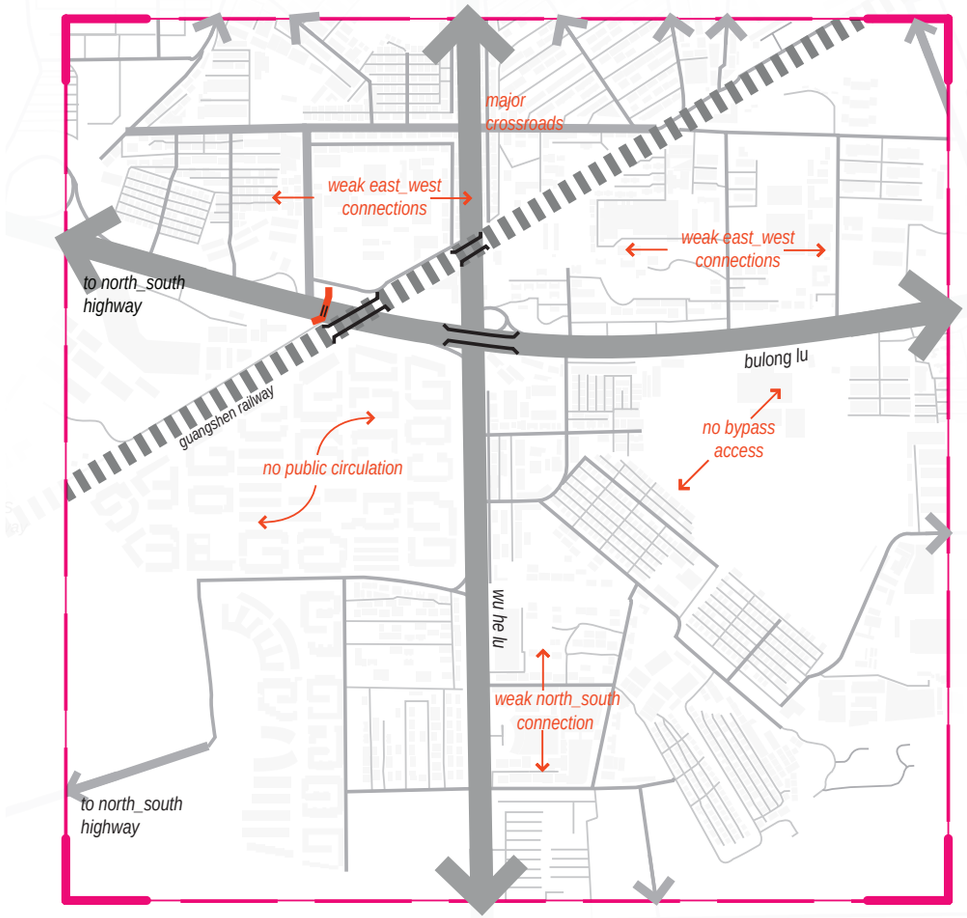
Photo by Stephen Crim

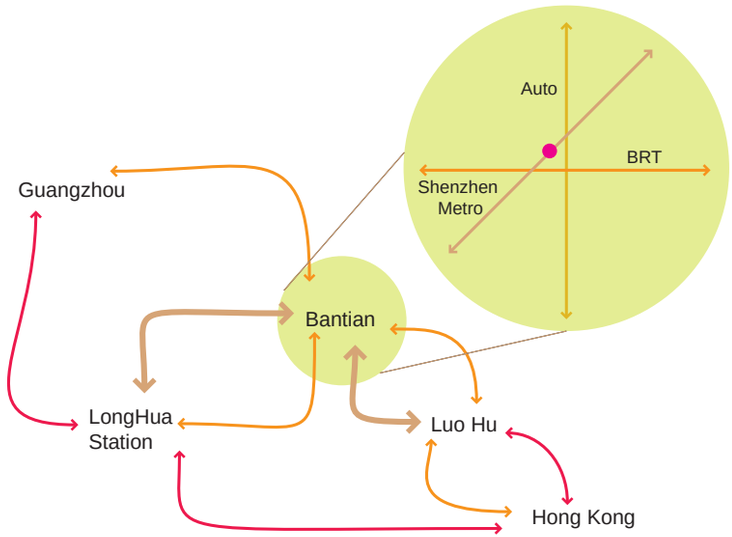
Photo courtesy Vanke

Photo by Astrid Wood

EXISTING CONDITIONS

{ REGION DISTRICT **INTERVENTION ZONE** }





The diagram above indicates the potential connections between Bantian and other areas of the Pearl River Delta. The diagram at left shows missing connections within Intervention Zone, in Bantian.

PATHS AND CIRCULATION

The Intervention Zone exhibits a wide-range of circulation patterns, road types, and road qualities. These patterns have implications for congestion and for accessibility to the surrounding neighborhoods. The two main arterials are the north-south Wu He Lu and the east-west Bulong Lu.

The attached diagram distinguishes between primary, secondary, and tertiary roads. Within these divisions, there remains great variety in road quality. For example, tertiary roads include unpaved truck access roads and narrow roads in high-density village housing.

ROAD NETWORK PROPERTIES

The properties of the road network pose major challenges to reducing automobile dependency. Many paths, often in grid form, are contained within distinct neighborhood, without easy connection to other areas. Often one or two main roads will provide acess to a large development, such that developments often function as autonomous units. Nonetheless, the congested corridors between neighborhoods often show patches of vibrancy. Wonderland clearly has limited public access, with one east-west road bisecting the site. A major north-south highway to the west of Wonderland is a major point of access that reinforces the value of the site area, but it is also a constraint as it encourages car traffic.

Linking the development-specific road networks to adjoining roads is important, but should happen without funneling traffic onto congested arterials. A connected network of primary, secondary, and tertiary roads could offer more options to travelers making intra-zonal and regional trips using a variety of modes.

ROAD DESIGN PROPERTIES SECTIONS

BULONG LU

Attributes of limited access highway:

* Wide landscaped shoulders, concrete barrier a median, 6 lanes of travel, turning ramps, and no traffic lights.

* Crossing the road as a vehicle occurs only at major intersections with Wu He Lu and the roundabout to the east.

* Crossing the road as a pedestrian is near impossible, with a singular pedestrian overpass to the west of Wu He Lu.

WU HE LU

Photo by Stephen Crim.

* Buildings are setback from the street with either landscape or asphalt buffers fronting the arterial.

EXISTING CONDITIONS

Community Facilities

shenzhen_*futures*

With just a few community facilities, barely any cultural facilities, and underutilized green spaces, there are many missing connections within the Longhua community.

POOR ACCESS

Bantian residents complain of the great trek to get from their neighborhood to Luohu. Without adequate mass transit access, residents are forced to drive. Visitors to the area have similar trouble accessing the site. Drivers have difficulty finding parking spaces and often avoid visiting Bantian.

Decreasing Property Values

Enhanced façade treatments will cause property values to increase. Road surfaces are not maintained. Cement is cracking. When it rains puddle collects and pedestrian activity is further deterred. Evidence of declining property values is visible from the types of commercial properties lining Bulong Lu. Instead of banks and restaurants, discount clothing stores stand opposite informal vendors.

Poor Transition between Public and Private Spaces

Poor transitions between public and private spaces create obstacles to easy movement. Irregular pedestrian paths make it difficult to walk through the neighborhoods. Hard barriers like fences stand atop land mounds, limiting pedestrian access. Physical barriers create social barriers.

Insufficient Street Activity

Bulong Lu is not a pleasant place to walk, stroll, and shop. Most of the side streets do not have sidewalks. Poor signage prevents the full use of the street. Street activity is present on the main arterials but is minimal within the blocks. Improved connections will make it easier and more desirable to walk, cycle, and drive.

Features Not Sensitive to Natural Environment

Bantian is brown. Large green parks lay just beyond reach for most Shenzhen residents. A 24-hectare open space is located 600 meters from Bulong Lu. This area is not visited because people cannot access the site. There are no bicycle or pedestrian trails to invite users to the park.

Missing a Distinctive Identity

Bantian is missing an identity. The site has no architectural or cultural institutions to help Bantian forge a neighborhood identity. No street markers indicate that Bantian is a special place. To be a great place, there need to clear reasons to live in and visit the area.

CONCEPT

Operating Principles

These principles demonstrate how to translate the general goals outlined above into a specific proposal for the redevelopment of the Longhua area of Shenzhen, the area surrounding the current Wonderland Development.

[CONCEPT 1]
A new sub-center of employment, housing, and culture for Shenzhen

As sub-center, this area should include the major amenities that any city should have, including entertainment, public facilities, and media for the interactive creation of cultural meaning.

The sub-center complements rather than replaces the center of Shenzhen.

[CONCEPT 2]
Neighborhood integration

While allowing distinct neighborhood identities to flourish, the proposal encourages connections between different places and different groups of people. In particular, it locates community facilities at neighborhoods intersections and locates public spaces at neighborhood intersections.

[CONCEPT 3]
Richly Layered Networks of Connections

Transit network includes a hierarchy of public transportation (heavy rail, bus rapid transit, regular buses, minibuses) and hierarchies of boulevards (arterials, primary and secondary roads, service streets, alleys).

Street network accommodates all kinds of transportation: public buses, mini-buses, personal automobiles, bikes, and walking.

Multi-modal green network connects to the 'gray' transit network and includes paths for walking, jogging, and biking.

All of these layers are coordinated with each other.

The layering of networks creates—and is shaped by—areas of meaning, beginning with the super-dense center and radiating towards the periphery.

[CONCEPT 4]
Intricate Pattern of Density

The highest density is located at the civic center associated with the transit hub.

High densities continue along the arterials.

Radiating density from core and arterials.

Density around open spaces and public spaces, created the vibrant public places discussed above. (Buildings must be sited carefully to avoid detrimental impacts on those spaces.)

Use the patterns of density to create distinct identities for individual neighborhoods.

[CONCEPT 5]

Active public spaces for locals and visitors

Invest heavily in multiple forms of public space: commercial, cultural and green. Create a continuum of spaces: from open space in the civic center, to a big urban park, to a greenway, to neighborhood parks.

Site a range of uses (commercial, green, cultural, and residential) within or adjacent to public spaces. The public spaces provide visual and cognitive relief to users, make the other uses more attractive, and enliven the public spaces themselves.

Locate public spaces between neighborhoods in order to bring distinct communities together rather than separating them.

Create spaces along arterials and along paths towardtransit, bringing locals to the transit network and visitors from the transit hub into the community.

[CONCEPT 6]

Reusing and adapting existing infrastructure

Follow existing patterns of neighborhood boundaries in creating new neighborhoods, leaving behind traces of the past.

Adapt some existing buildings to new uses where allowed by context.

While allowing for radical change, encourage new buildings to reference previous layers of inhabitation in this area.

[CONCEPT 7]

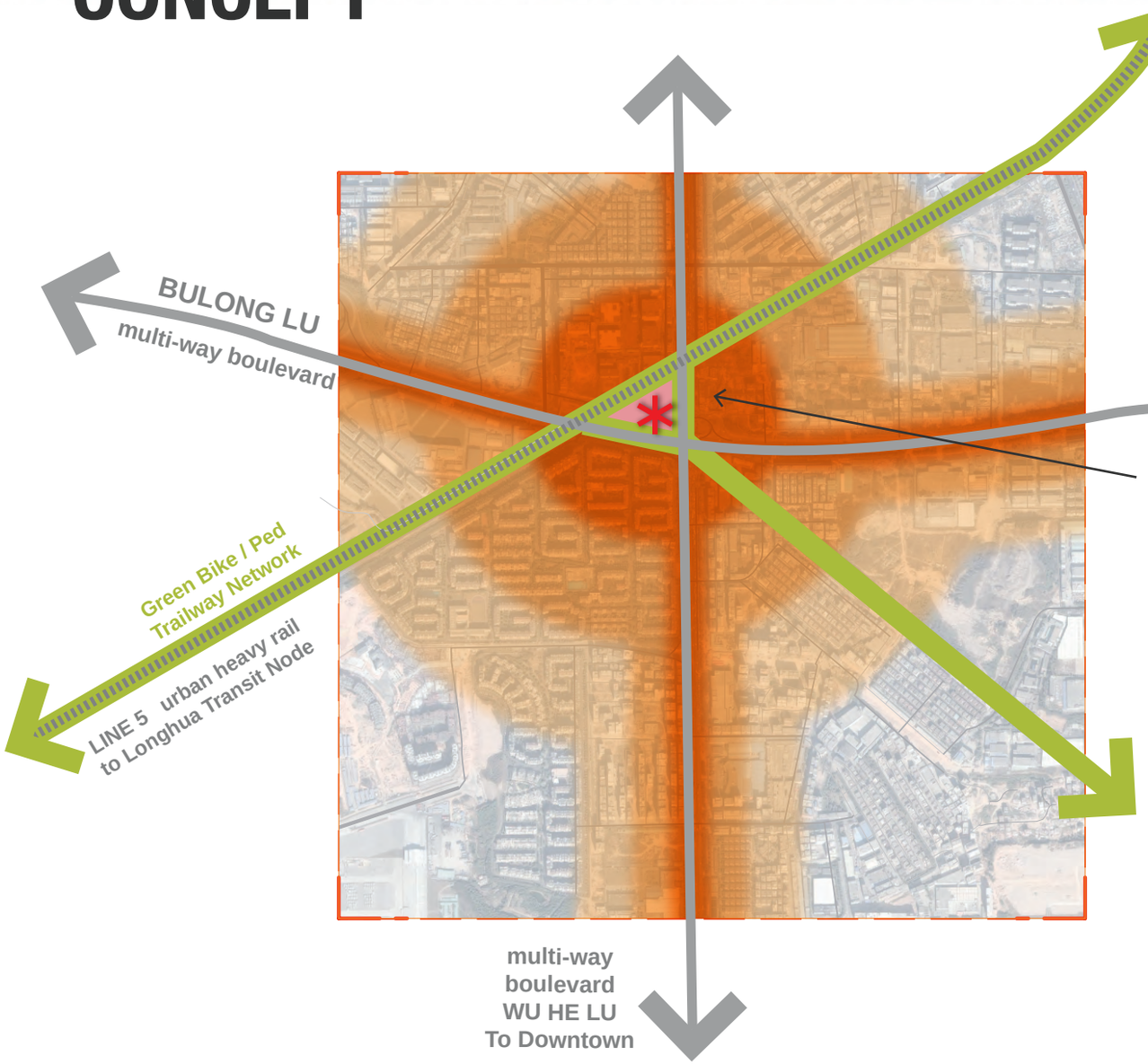
All principles converge at the civic center

The civic center—based on the transit hub—embodies all of these principles.

As a microcosm of the entire zone, the civic center contains residences, offices, shops, communal facilities, and open space.

Development throughout the zone points towards the civic center through physical connections.

CONCEPT



Density at the center & along major pathways

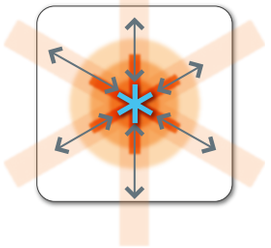
{high-density, multi-path, mixed-use node}

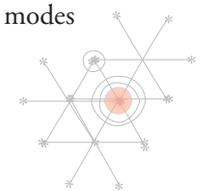
- three major coplanar axes separated by 60°
- maximum connectivity, dynamic spaces
- densest development in center, along axes
- lower density moving outward
- integrated with existing streets and fabric

NODE:

{auto, bus, brt, subway, bike / ped, urban rail}

- point of access for the entire district
- public space; semi-open center with dense mixed-use
- flexible central space for multiple civic / public uses
  as well as switching between transportaion modes





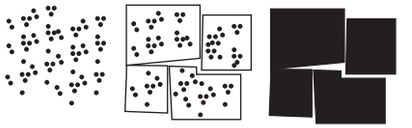
Connections Diagram

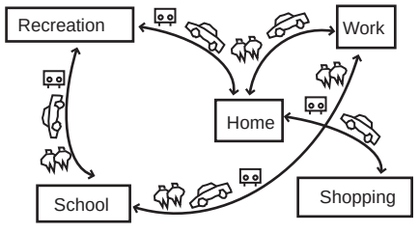
Connections Diagram

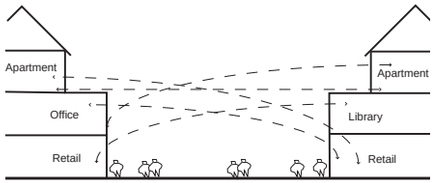
Individual households are disconnected from their communal environments. Rapid economic growth has torn the community apart.

The proposed intervention establishes pathways and places that develop connections between what people do, where they live and work, and how they get there. Improved access will create community connections. People can be united through new eating, shopping, working and entertainment facilities. New public transportation systems will increase interaction. Improved green spaces will provide places will enhance community connections.

The overall goal of this plan is to build communities by increasing access and providing people with a reason to live, work and play in Bantian.







PROPOSAL

Guidelines

Major Features

The major features of the zone shape its character because individual developments respond directly to those features. Some of the features are concentrated locations of activity, such as the station/civic center and a substantial park. Others are linear features that run through the length of the zone, including the greenway (along the rail line) and the two major arterials.

The diagram to the right illustrates the extent of the influence of these features, and the attached table enumerates the specific character of those zones. Beyond general character, it also contains guidelines with regard to the form and the density of the buildings near these features. Together these guidelines will structure the development of the Intervention Zone as a whole and give identity to individual components of it.

Within 200 m of Station

{FAR: 6.5–7.5 Height: 25–35 floors}

By locating the highest density around the transit station, the activities of the entire intervention zone converge on this intense center. The combination of dense development, numerous commercial establishments, and a concentration of communal facilities create the atmosphere of a vibrant civic center.

Within 100 m of Bulong Lu

{FAR: 4.5–5.5 Height: 15–20 floors}

A spine of density and activity will feed off the Bus Rapid Transit (BRT) line planned for this east-west arterial, structuring the form of the zone. High-density commercial and residential buildings will create an extended mixed-use area along this boulevard, bringing the excitement of the civic center into the surrounding neighborhoods.

Within 100 m of Wu He Lu

{FAR: 4.5–5.5 Height: 15–20 floors}

A second spine of density and activity will feed off the BRT line planned for this north-south arterial, giving further structure to the zone and creating a lively atmosphere.

Within 100 m of Greenway

{FAR: 4–4.5 Height: 12-18 floors}

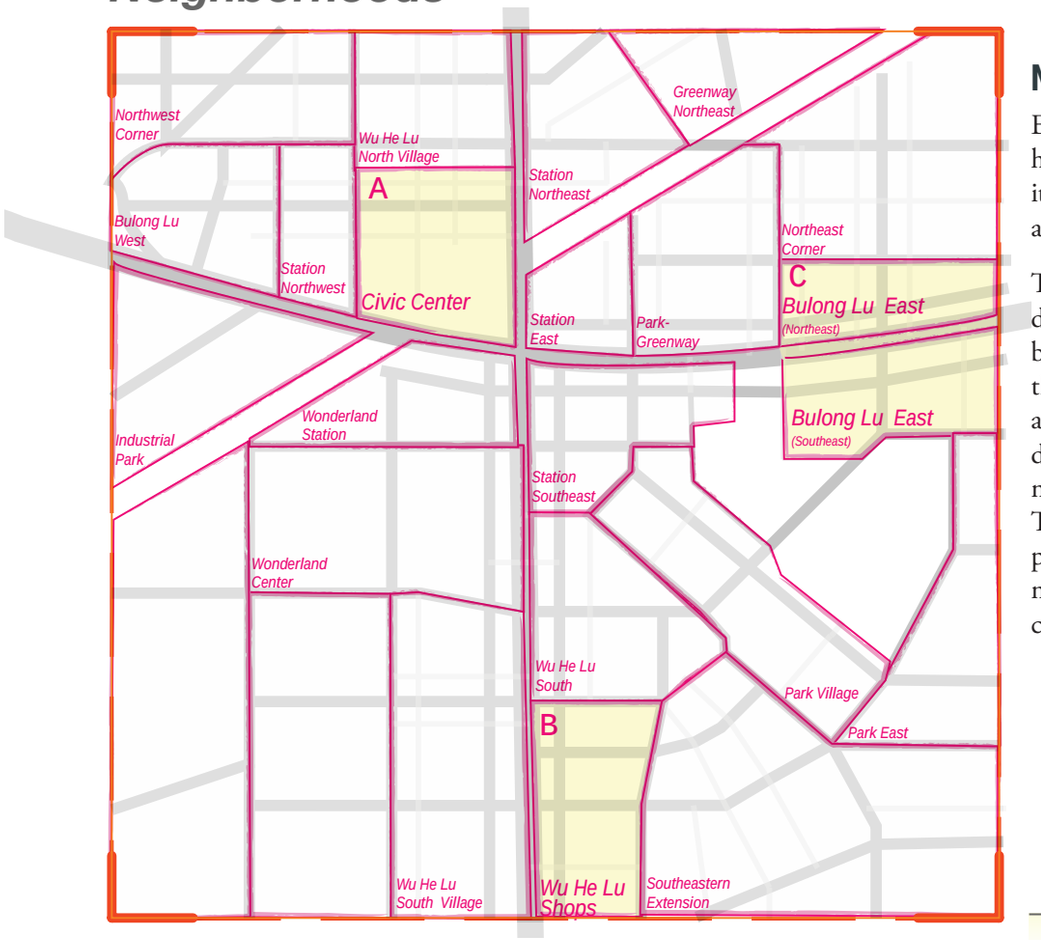
The greenway will provide space for exercise, recreation, non-motorized transport, and quiet reflection. The two 100-meter strips of land abutting the greenway will create a zone of high-density that contributes to frequent use of this open-space network.

Within 100 m of Park

{FAR: 4 Height: 12–18 floors}

The zone of density around the park maximizes activity and the enjoyment of this amenity. The park also provides relief in response to the density of the surrounding band of development.

Neighborhoods

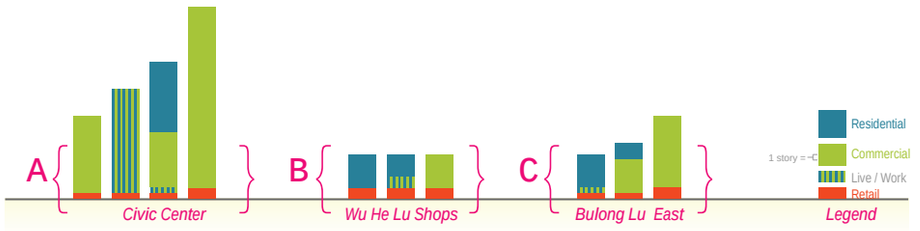


Neighborhoods and Nodes

Each of these 24 neighborhoods will have a distinct character based on its location in the intervention zone and its relationship to its neighbors.

The boundaries on the attached diagram do not indicate divisions between places and groups; rather they suggest transitions in the character of the places. The pattern of development will connect disparate neighborhoods and populations. The following table describes the proposed nature of each of these neighborhoods, including the physical form, land use and population.

Three neighborhoods stand out in importance. The first is the Civic Center, which revolves around the transit station. This Dense zone of residences, offices, shops, and community facilities is discussed in detail below. The second is the Bulong Lu East area, the zone's secondary office node. Finally, the Shops at Wu He Lu contain a cluster of retail based on an existing mall that draws shoppers from throughout the region. The facilities at each node will be easily accessible through the proposed public transportation network.



PROPOSAL

Neighborhood Characteristics

Name	FAR	Height	Pop.	Pop/ha	Description
Eco-Industr Park	2	6-8	1,189	107	The Eco-Industrial Park will be a center for light industrial facilities, including research and development establishments. The small percentage of housing serves local workers.
Civic Center	7	25-35	12,750	1250	As the core of the intervention zone, the Civic Center will contain the highest residential and commercial densities, as well as many other cultural amenities.
Bulong Lu Northeast	3	12-18	3,321	536	Centered on a BRT stop along the Bulong Lu arterial, the commercial development of the zone will be concentrated along the arterial spine.
Bulong Lu Southeast	4	12-18	6,000	714	Like its counterpart to the north, this neighborhood will be centered on a BRT stop along the Bulong Lu arterial. Commercial development will be concentrated along the arterial spine.
The Shops at Wu He Lu	1.5	4-8	2,799	295	Building on an existing mall in this neighborhood, the addition of significant mid-rise residential will create a mixed-use zone. This neighborhood will be one of the primary nodes of commercial activity within the intervention zone.
Station East	5	20-25	4,714	1071	Adjacent to the civic center, this area will include high-density, high-rise residential development and a subtantial collection of offices.
Station Northwest	5	20-25	5,804	1161	Adjacent to the civic center, this area will include high-density, high-rise residential development and a subtantial collection of offices.
	5	20-25	8,705	1161	Located across from the Civic Center, this high-density and mixed-use redevelopment of the north portion of Wonderland will mirror the activity in the Civic Center to the north.
Station Southeast	4	12-18	8,500	1000	Wedged in between the area's two main arterial roads, this neighborhood neighborhood will contain a pedestrian path that connects the park to the station center.
Station Northeast	4	12-18	9,943	1143	Near to the civic center, a busway/arterial, and the greenway, this vibrant area will include substantial residential densities and a modest amount of commercial development.
Bulong Lu West	3	8-15	7,114	857	This medium-rise residential area will be located at the western end of Bulong Lu. The office space within this zone will be concentrated along the Bulong Lu edge.
Park-Greenway	3	8-15	9,000	857	This neighborhood of mid- and high-rise residential buildings will form a strong connection between the greenway and the central park via a small spine of commercial activity.

Name	FAR	Height	Pop.	Pop/ha	Description
	3	9-15	13,971	857	By doubling the existing density of the central area of Wonderland, this neighborhood will take advantage of the proximity to the station and to the Wu He Lu arterial. It will be a transition between high densities at Wonderland Station and lower densities at Wonderland south.
Park East	1.5	4-15	4,071	429	East of the park will be a relatively low-density zone. Within the low-density zone, built form will be concentrated along the park boundary, with several high-rises overlooking the park and strengthening the overall form of the park.
Wu He Lu South Village	1.5	4-10	7,200	429	This mid-rise neighborhood will build off an existing village pattern, approximating the overall density of the current Wonderland development.
Wu He Lu South	2.5	8-12	7,893	759	A residential neighborhood along Wu He Lu will be located immediately to the north of the Shops at Wu He Lu, a regional shopping district.
Northwest Corner	1	3-7	3,536	321	This residential area on the periphery of the zone will contain relatively low-density housing because of its distance from the transit network.
Wu He Lu North Village	3	8-15	8,196	964	This mid-rise residential neighborhood will be located along the Wu He Lu arterial. Beyond the local neighborhood shops, other commercial uses will be located immediately to the south, in the Station Northwest neighborhood.
Greenway Northeast	3	8-15	5,786	964	Adjacent to the greenway, this neighborhood will contain a moderate density of residential development. Commercial development is limited to neighborhood shopping.
Northeast Corner	1	9-15	5,464	321	This residential area on the periphery of the zone will contain relatively low-density housing because of its distance from the transit network.
SW Extension	1	5-8	7,457	321	This residential area on the periphery of the zone will contain relatively low-density housing because of its distance from the transit network.
Park Village	3	7-15	12,150	964	This neighborhood will incorporate two existing village clusters into a moderate density zone. High-rise buildings will be located along the central park, bringing residential density towards this central greenspace. Shopping will be concentrated in the center of this node.
	1.5	4-10	8,727	482	Because of the distance from the transit hub, this area of Wonderland will retain the current density and character of mid-rise residential buildings.
SE Extension	1	3-7	8,775	321	This residential area on the periphery of the zone will contain relatively low-density housing because of its distance from the transit hub.

PROPOSAL

Density

The densities throughout the intervention zone are shaped by the character of individual neighborhoods and their relationships to major features. In general, higher density areas are located in proximity to the Civic Center and along major arterials that accommodate public transportation. The adjacent diagram illustrates the patterns of density by block. (The blocks depicted are formed by primary and secondary roads; tertiary roads will further divide the blocks but are not shown on this diagram.)

The densities across the Intervention Zone range from a FAR of 1.0 near areas at the periphery of the zone, with buildings of just several stories, to an FAR (Floor Area Ratio) of 8.0 in the central area of the station, with buildings soaring up to 35 stories. In order to convert these building densities into population densities, The current per capita gross floor area of Wonderland of 28 square meters per person was used as a guide. Although this is higher than the current densities in China, growing unit sizes suggest that this is a reasonable average for use in describing the future of a dense and growing Bantian area.

FAR

- >6
- 4 - 5
- 3
- 1.5 - 2.5
- 1

Combining this figure with patterns of density described in the adjacent diagram yields an overall proposed gross density of approximately 566 persons per hectare, which is a slight increase over Wonderland's current density of 540 persons per hectare. The total population of the Intervention Zone, as proposed, would be approximately 173,000 residents. Further details about the densities and populations of the individual neighborhoods can be found in the detailed neighborhood table.

Land Use

The pattern of land use in the Intervention Zone is shaped by the character of individual neighborhoods and the relationships to major features that were presented above. Throughout the Intervention Zone, land uses are mixed in order to create vibrant neighborhoods and to increase the number of activities accessible through walking, biking, and public transportation.

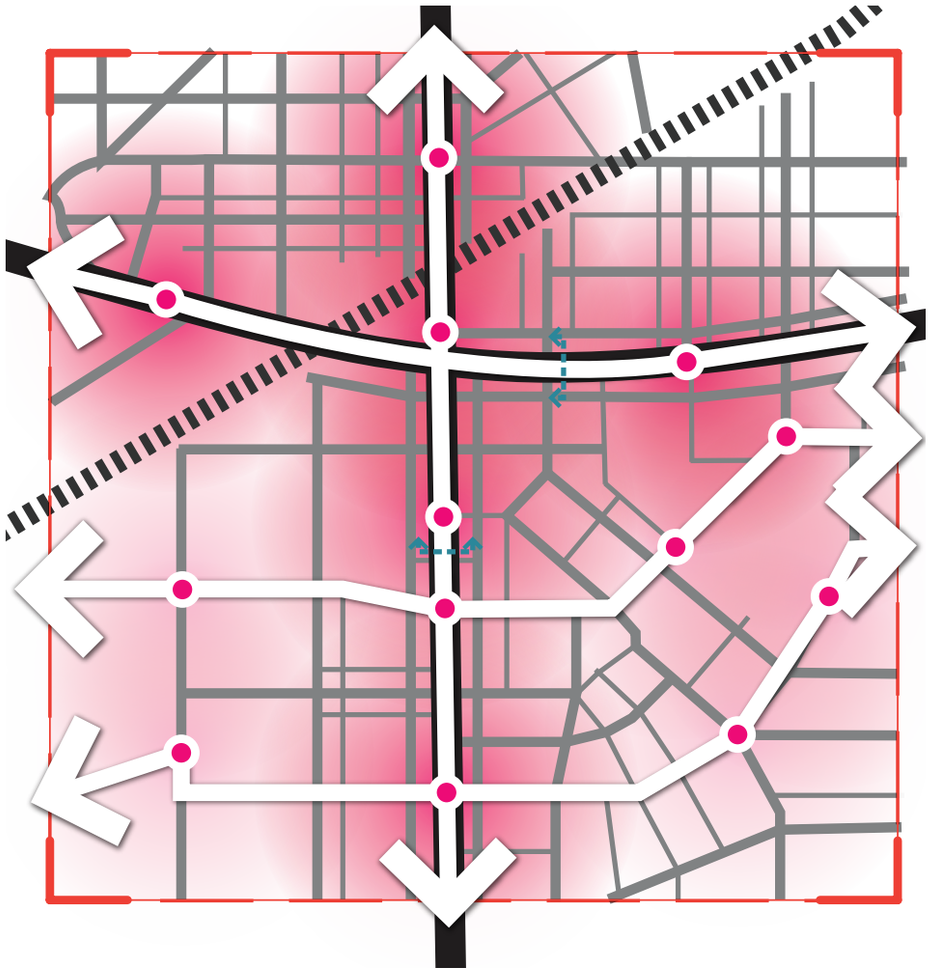
The high densities and focus on the public transportation of this proposal support a relatively constant level of retail development throughout the Intervention Zone. In most neighborhoods, almost 10% of the area will be devoted to retail. Along the major roads and in the major nodes, the amount of retail will be somewhat higher. However, across the zone the balance between office development and residential development varies greatly, from 15% residential to 90% residential and from 75% office space to areas of negligible office development. The adjacent diagram shows the proposed patterns of residential and commercial development across the Intervention Zone. In addition to the agglomerations of offices along major arterials and in several nodes, small concentrations of offices will be located along the mini-boulevards that penetrate the neighborhoods, bringing a mix of people into the individual neighborhoods. This mix of uses will increase the quality of life that residents, workers, and visitors enjoy in this area of Shenzhen.

Percentage Residential (built area)

- Less than 60%
- 65-75%
- 80 - 85%
- Greater than 90%

PROPOSAL

Circulation



The proposal for multimodal circulation in the Intervention Zone has several goals:

* To minimize congestion and distribute vehicular circulation within the intervention zone network and within regional transportation networks.

* To ensure pedestrian and bicycle quality of travel within the zone, particularly easing travel towards the civic center.

* To provide a framework for land uses such that non-auto travel is the preferred mode of access for retail, office, and recreational destinations.

Transit

Transit is the most important infrastructure and framework for guiding development in Bantian. The new transit station will be at the intersection of Bulong Lu and Wu He Lu.

There are several primary components of the transit-based development:

* A dense core of development adjacent to the Line 5 station creates a civic center and major subcenter for office and cultural activities.

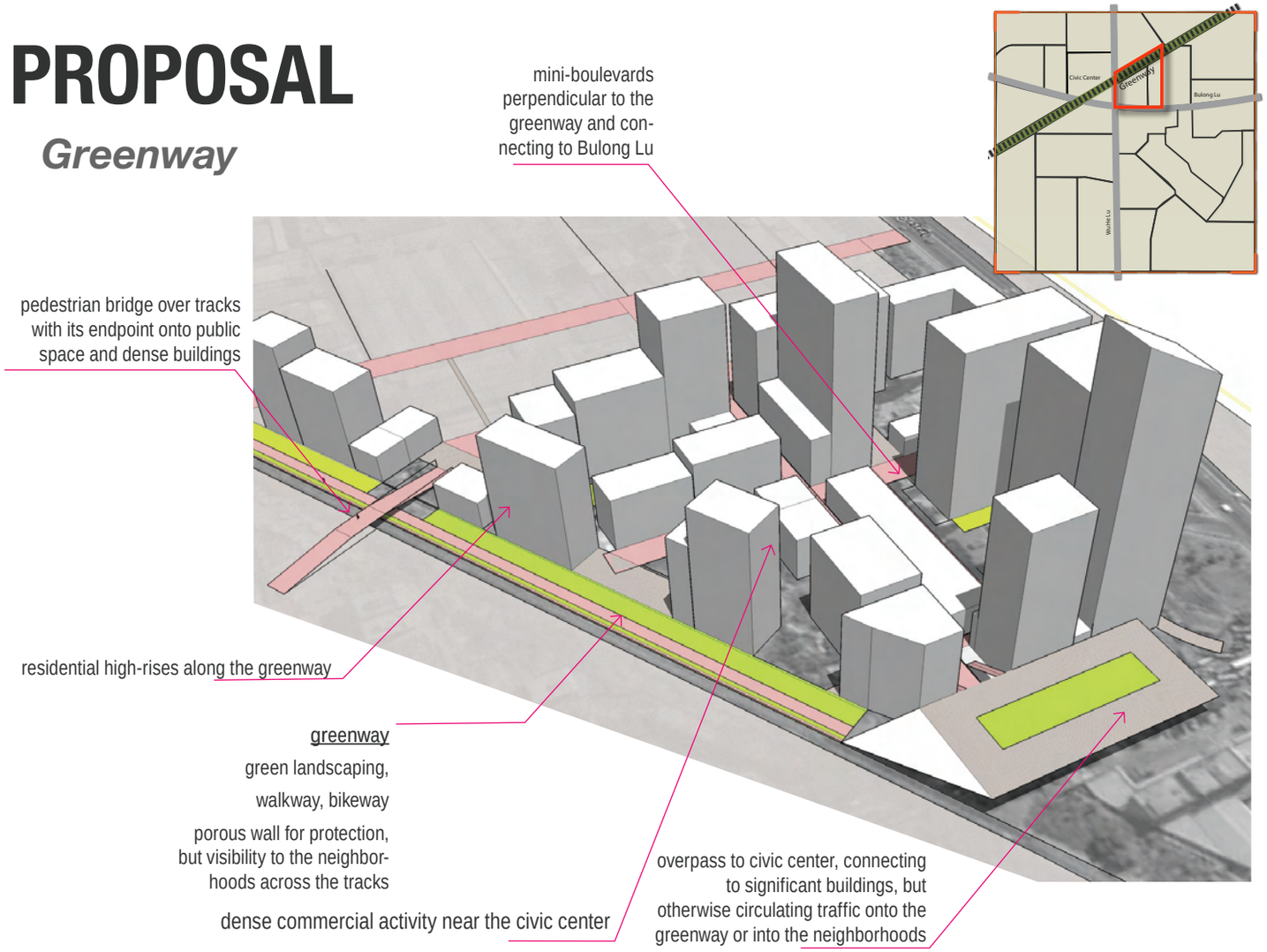
* High-speed bus systems along Bulong Lu and Wu He Lu provide seamless connections from the station and along the main arterials to other city and regional destinations.

* The main bus stops will be separated by approximately 500 to 600 meters, providing significant, overlapping transit coverage for the area.

* Pedestrian and bicycle connections along the greenway in the "active backyards of neighborhoods" are the backbone of a network of biking and walking with easy transfers to transit. The network will include paths along the main multi-way boulevards and the connecting mini-boulevards.

PROPOSAL

Greenway



The proposed greenway will fulfill many functions:

* Multimodal path for bikers and pedestrians to reach the civic center and to travel to other parts of the district.

* A place of exploration and recreation, complemented by numerous public spaces adjacent to the greenway.

* Each adjacent public space will be a point of convergence for those passing by and those in the abutting residential neighborhoods, providing amenities such as playgrounds, picnic areas, public bathrooms, and spaces for reflection.

* Public spaces will be endpoints for the mini-boulevards that penetrate each of the residential areas from either Bulong Lu or Wu He Lu.

PROPOSAL

Circulation Components and Conditions

AXES

Bulong Lu and Wu He Lu will be converted to multi-way boulevards with the following elements:

* Vehicular capacity unchanged

* Adding dedicated bus lanes with formalized bus stop design

* Adding service lanes for parking and access to perpendicular roads

* Median and shoulder landscaping to buffer pedestrian streetscape

* A new type of development along Wu He Lu that adds a layer of density onto existing buildings, plus a series of cantilevered buildings on the western end that creates a shaded bikeway and extends development to the street

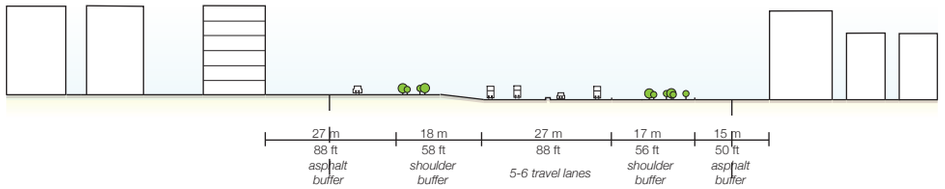
* A dense corridor along Bulong Lu lined by office buildings, but also a public spaces that offer relief but also provide connections to the interior neighborhoods.

* Relief roads that parallel Bulong Lu and Wu He Lu to support local cross-neighborhood travel.

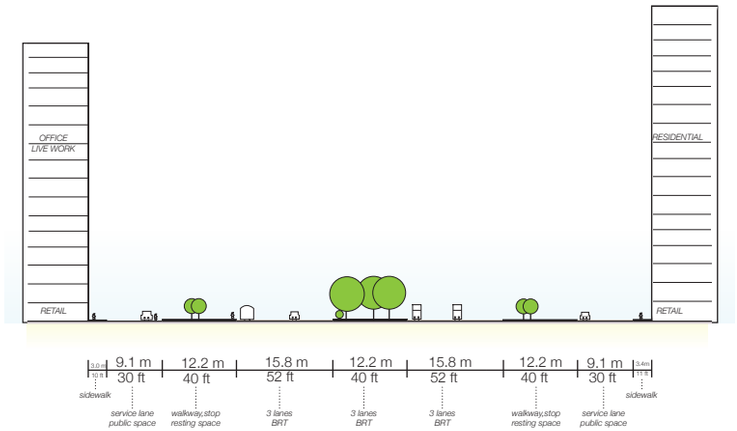
* Mini-boulevards perpendicular to Bulong Lu and Wu He Lu to serve as feeders into the neighborhoods—they are lined by retail and feature plazas or open spaces as endpoints, facilitating interesting, human-scale travel to homes, shopping, and public places

* Upgraded capability of east-west roads to connect to areas outside the intervention zone

The aim of the new road system is to create travel options, to decrease reliance on primary highway-like roads to distribute regional traffic in an urban environment, and to support new land uses.

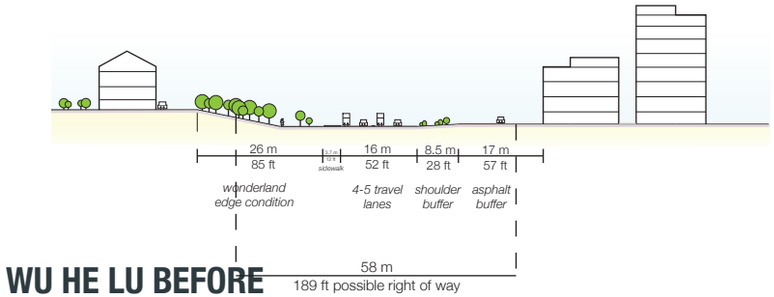


BULONG LU BEFORE

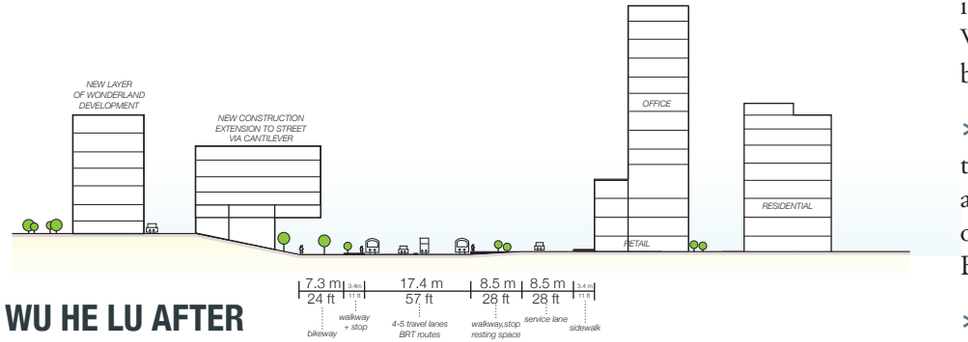


BULONG LU AFTER

shenzhen_futures



WU HE LU BEFORE



WU HE LU AFTER

PEDESTRIAN

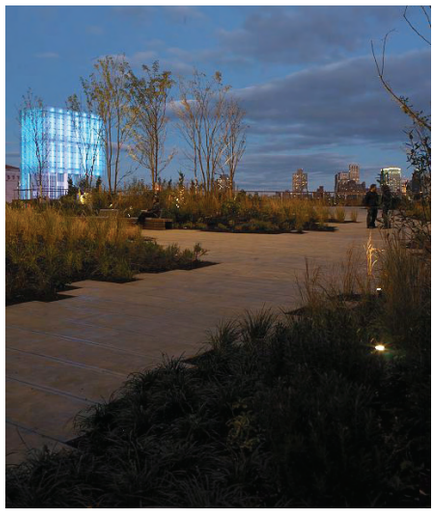
Because the human scale is critical to circulation, the proposal ensures that travel to activities is easy, fast, comfortable, and effective. The following elements provide for an effective pedestrian system:

* Shaded sidewalks and interesting streetscapes along Bulong Lu, Wu He Lu, the orthogonal mini-boulevards, and the Civic Center

* Above-grade connections to the Civic Center that are lined by activity and lead to other points of activity, including nodes across Bulong Lu and Wu He Lu

* An extended elevated pedestrian connection leading to the park lined by greenery and connected to several high-rises.

* A greenway along Line 5 that provides a travel amenity and a recreational amenity with connections to public spaces and community facilities, complemented by public spaces with pedestrian bridges connecting neighborhoods.



55 Water Street in New York City - an elevated, restful plaza and circulation path. Formal landscape and street furniture along with spacious connections to the street . http://www.flickr.com/photos/cwofford/sets/1214929

PROPOSAL

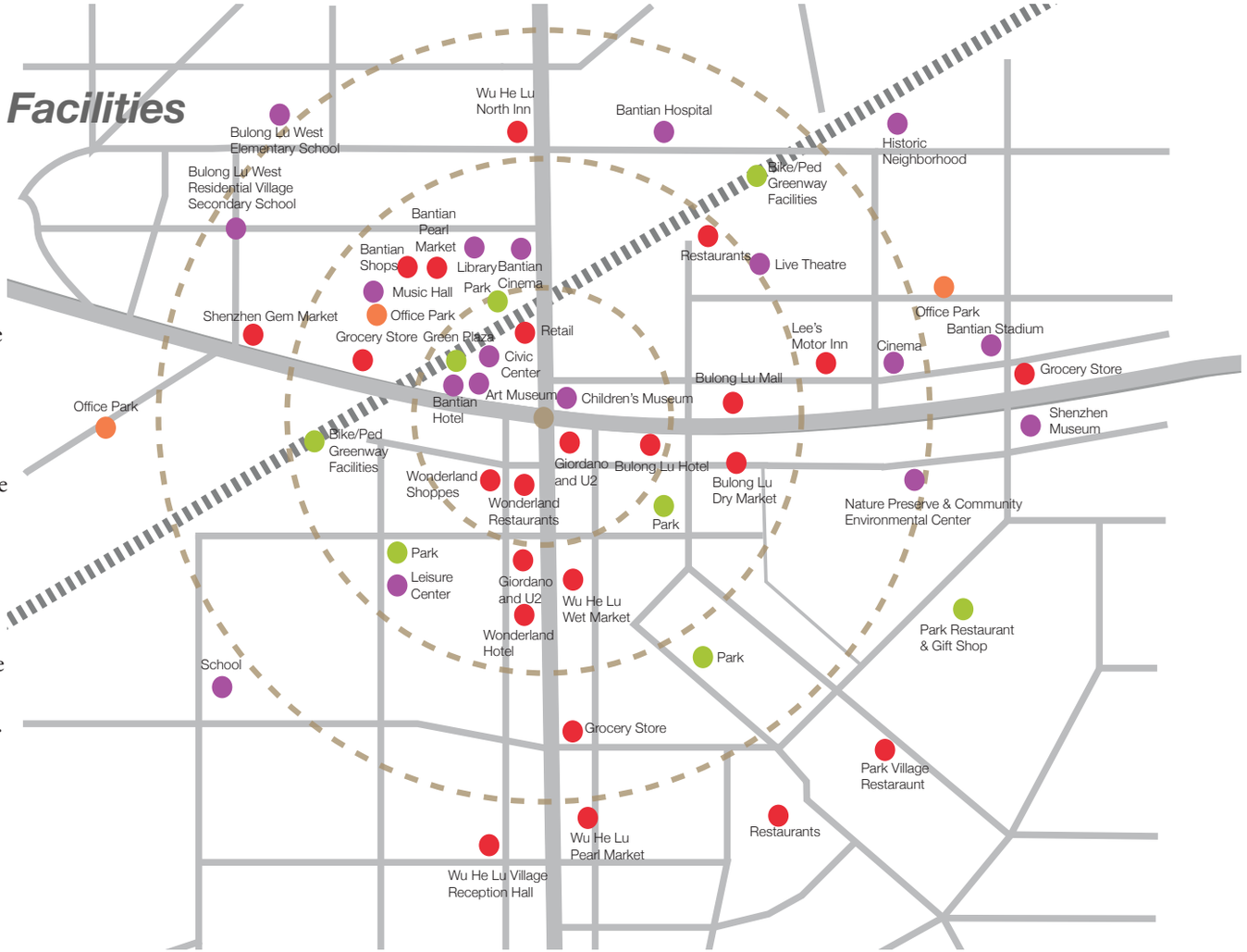
Proposed Community Facilities

Adding new commercial, cultural, and outdoor facilities will provide places to build community while also revitalizing the Bantian neighborhood. Facilities such as these can be used by visitors and locals alike. Placing people together will generate interactions and help build community.

New commercial facilities will provide people with a reason to shop locally. Purchasing goods together is a way to forge new communities. These retailers will invite outsiders into the community and expand diversity in the area.

Mixing uses within buildings will provide people with more reasons to cross the same spaces. Children can play together in the park, while the parents discuss local issues.

Innovative design will integrate public and private spaces and form community environments. Public plazas offer individuals in the community a place to gather for large- and small-scale gatherings.



shenzhen_futures

Programming

Each residential neighborhood will have its own cluster of retail and restaurants as well as facilities that serve the large area. A balance of local and regional facilities will help connect locals to their immediate neighborhoods and to people in Shenzhen at-large.

Cultural Facilities

Building new cultural facilities will provide the district with a distinct identity and invite visitors to the area. Cultural facilities need to be clustered together to maximize visibility. Scattering a balance of retail and green space will increase viability. These spaces should be located close to the train station and dispersed along the ground floor, close to the pedestrian pathways. Museums should be handicap accessible. Cultural amenities must be careful not to focus too heavily on visitors or the night/weekend crowd and must attract interest from families. The success of community facilities is in the versatility of the spaces to meet the needs of all types of users. Examples of proposed facilities include a new library, art museum, cinema, children's center and hospital.

Restaurants

As incomes rise, people tend to spend more time dining out of the home. Residents of Bantian are becoming increasingly wealthy and therefore have more money to spend in restaurants and less time to cook at home. Our intervention suggests building more than one hundred dining facilities to serve a variety of needs. People may want to grab a quick bite to eat or to enjoy a luxury meal at other times. Dining facilities will be arranged to meet these needs. Quick take-away restaurants will be located near pathways and have short-term parking for easier access. More lavish dining areas may be located on the top floor on a rotating spindle to maximize views.

Retail

Placing retail on the ground floor increases street activity. Retail should be used to increase traffic and visibility, and it should be scattered between larger venues. For this reason, shopping often accompanies other cultural facilities such as museums. Developing a mix of indoor and outdoor retail is recommended.

Recreational Space

The open spaces in the Civic Center can be used for temporary commercial activity. Additional, programmed are needed to ensure that this commercial activity can continue. While permanent facilities will be built in the periphery, green space will provide spaces for seasonal markets as well.

Facilities	*Area (m^2 / 1000 persons)*
Restaurants (approx. 100 in Civic Center)	*2000*
Retail (approx. 100 in Civic Center)	*2000*
Office Space	*1670*
Grocery Stores	*150*
Recreational Facilities	*70*
Library	*70*
Museums	*130*
Hotels	*150*
Theatres	*130*
Schools	*4670*
Parks and Green Space	*1000*

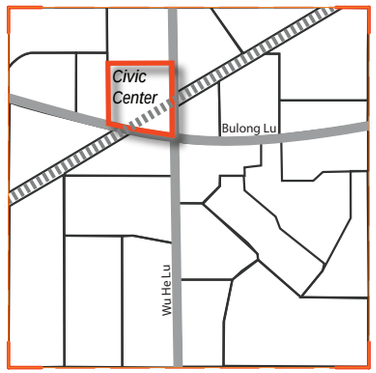
PROPOSAL

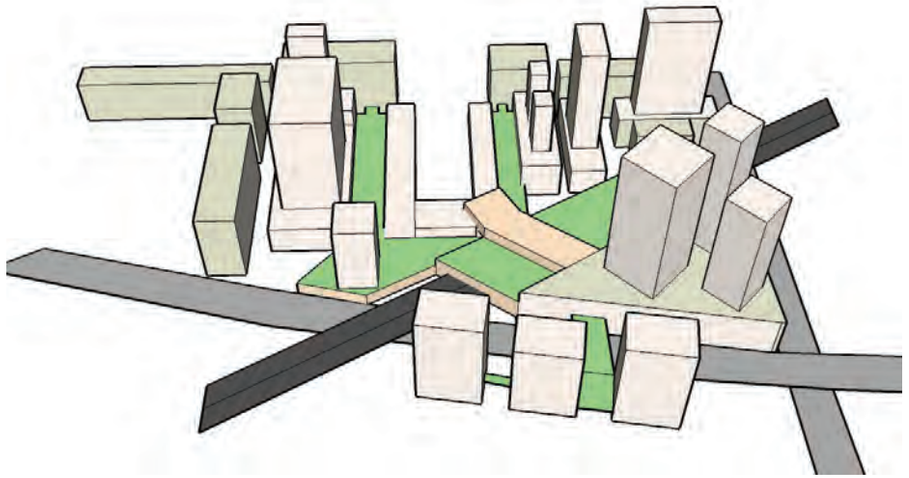
Civic Center

A VIBRANT, VERTICAL HUB

As the Shenzhen Metro expands, a new station will be located close to the existing Wonderland site in Bantian, providing east-west service on the Number Five line and connecting to local transit services. By surrounding this transit hub with dense residential development, offices, shops, community facilities, and open spaces, it can fulfill its potential as a hub of activity for the various neighborhoods that make up the district.

In order to maximize the impact of the station and associated Civic Center, the station should be located on an underused piece of industrial property northeast of the intersection of Bulong Lu and Wu He Lu, along side the existing Guangshen rail line. As the home to a civic center, this would become a locus of movement and a key node the routines of local residents and workers.





Northern View

Civic Center Components

At street level, bus stations and taxi stands will allow for convenient connections between transit modes, and a 1000-car garage will allow those who live beyond walking distance to easily travel the last few miles from the transit system to their destination. One level above, the station will connect riders to the rest of the city, and, through the new inter-city rail station at Longhua, the rest of the Pearl River Delta. With the extension of the number one metro line to Shenzhen International Airport, Bantian residents will be able to access national and international air travel with only one rail transfer.

Above the metro station, dense, high-rise space for residential, commercial, retail, civic, and cultural uses will generate and attract trips on the metro line and make the center a destination for Bantian residents regardless of whether they frequently use the metro system. Ideally, these spaces will be designed with unique architectural styles to make it a stunning centerpiece to the district. Room for art installations in all media will add unique color.

Open spaces and pedestrian pathways will create a pleasant environment for walkers and cyclists, with elevated pedestrian bridges crossing wide, uninviting streets like Bulong Lu, breaking the barriers they provide to pedestrians, and connecting the center to sky lobbies in abutting towers and to the neighborhoods beyond. A network of green spaces at the ground level, atop roof decks, and on aerial pathways will create space for relaxation and recreation with ample space shaded by canopies and trees to provide shelter from the tropical climate.

This program will transform the intersection of Bulong Lu and Wu He Lu into a lively center for the residents of Bantian, providing access to a host of amenities—including jobs and residences—within the center and beyond.

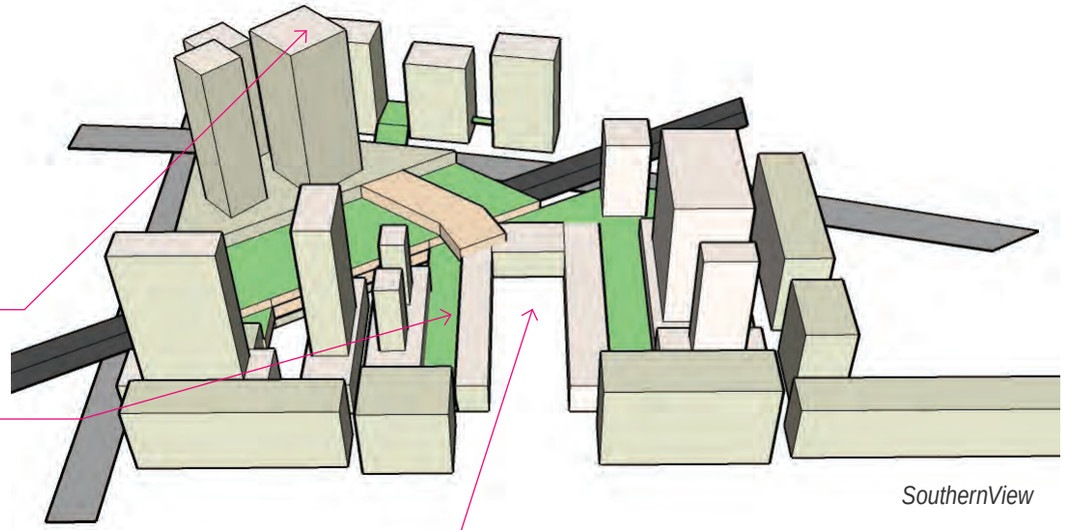
Pedestrian Circulation Diagram

PROPOSAL

Civic Center Views

A bird's eye view of the station

Source: www.jerde.com/projects



SouthernView

Shopping Arcades

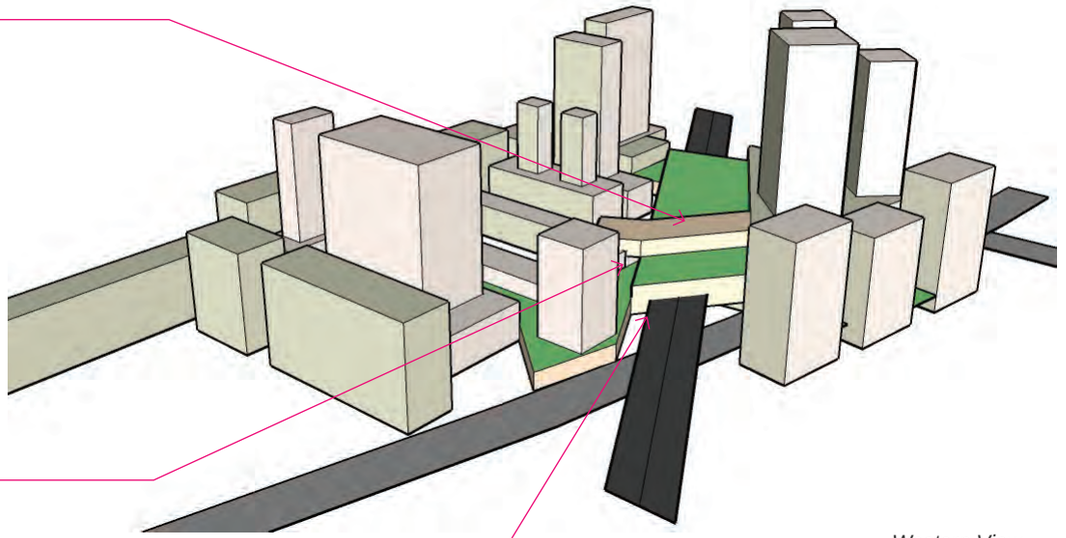
Source: www.arraken.ch/asia2006/CIMG1381.jpg

Gateway to Bantian Plaza

Source: SWAGroup.com

Elevated walkways connect buildings

Photo by Astrid Wood



Western View

Elevated Greenways

Photo by Astrid Wood

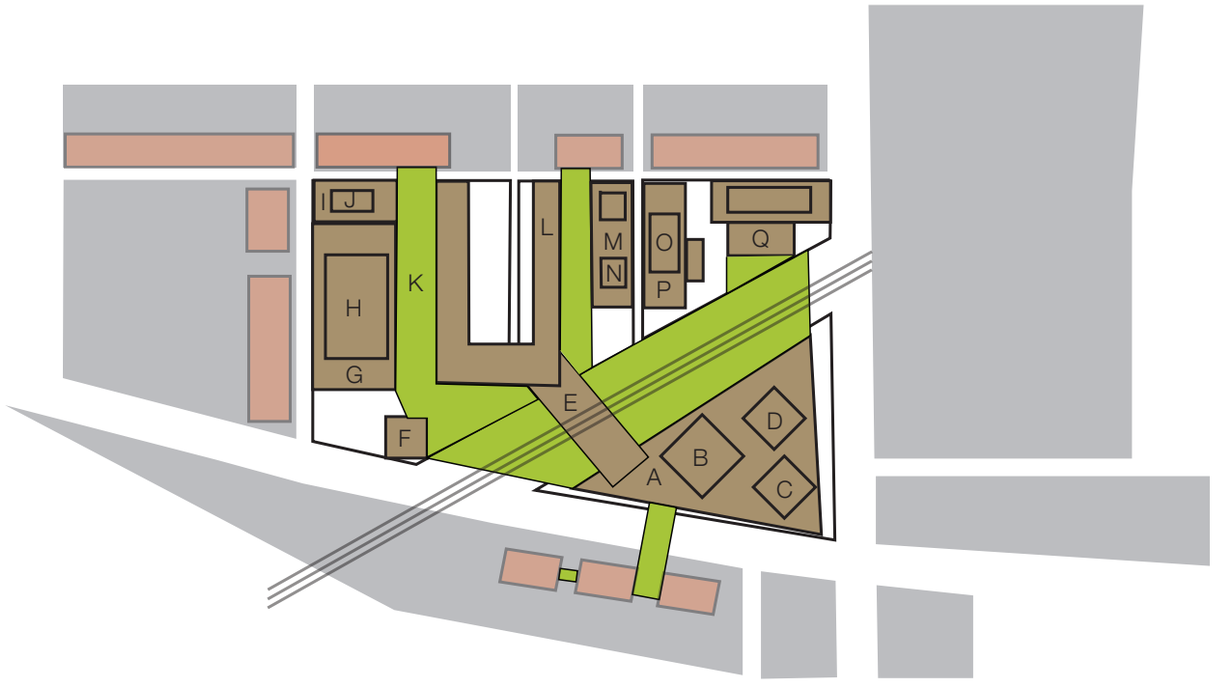
Tracks cut through dense urban center

Source: www.virgin-vacations.com/site_vv/11-top-underground-transit-systems-in-the-world.asp

PROPOSAL

Civic Center Programming

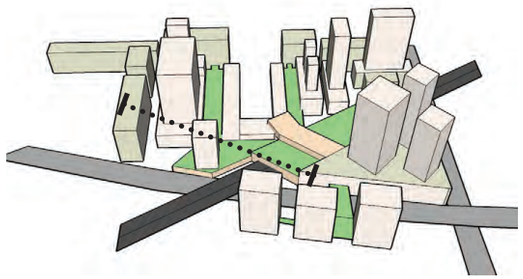
	Facility	Floors	Area (m2)
A	Train Station	10	96000
B	Office Tower	35	87500
C	Bantian Hotel	33	46406
D	Office Tower	35	49219
E	Pedestrian Bridge	8	13440
F	Office Tower	18	2813
G	Grocery Store	6	30000
H	Residential	26	73125
I	Music Hall	10	12500
J	Office Tower	28	8750
K	Retail Arcade	3	462000
L	Bantian Shops	6	31830
M	Bantian Pearl Market	9	16875
N	Office Tower	22	5775
O	Office Tower	30	18750
P	Cinema & Library	6	11250
Q	Retail Markets	6	13500
	Total		979733
	Total Lot Size		144332
	FAR		7



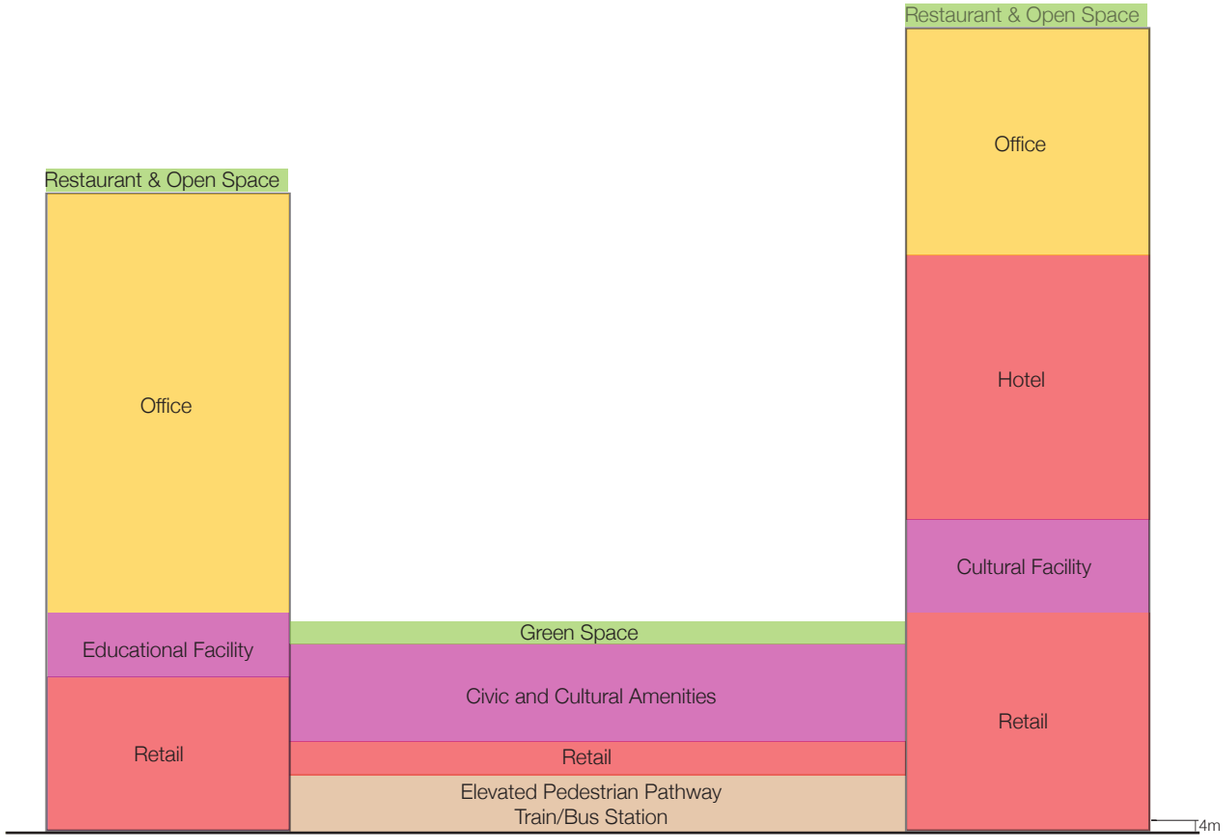
shenzhen_futures

Civic Center Section

A mixture of uses within buildings is recommended to maximize pedestrian traffic. Public facilities such as retail should be located on the bottom floors and private uses, such as office space, on upper floors.

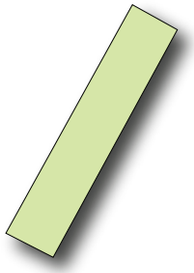


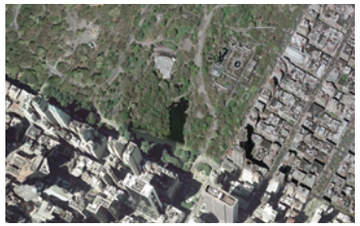
Northern View



PROPOSAL

Park and Edge Conditions Examples





CENTRAL PARK

NEW YORK 341 HA

The common and garden are surrounded by two distinct neighborhoods - Back Bay on the west and Beacon Hill to the north. Both are very dense but low-rise. The other sides consist of high-rises, intense retail activity, and connections to other downtown Boston neighborhoods.

GREEN LAKE PARK

KUNMING EST. 20 HA

Major commercial and civic activity surrounds this park, which consists of many lagoon-like environments with active play areas. The park is slightly offset from the major crossroads, similar to the Bantian condition.

COMMON + PUBLIC GARDEN

BOSTON 28 HA

Residential, commercial, cultural, and civic buildings align Central Park creating an incredibly active and valuable edge condition. The park itself is the major resting and play space of the city, and its surrounding density complements the green space of the city.

BANTIAN URBAN PARK

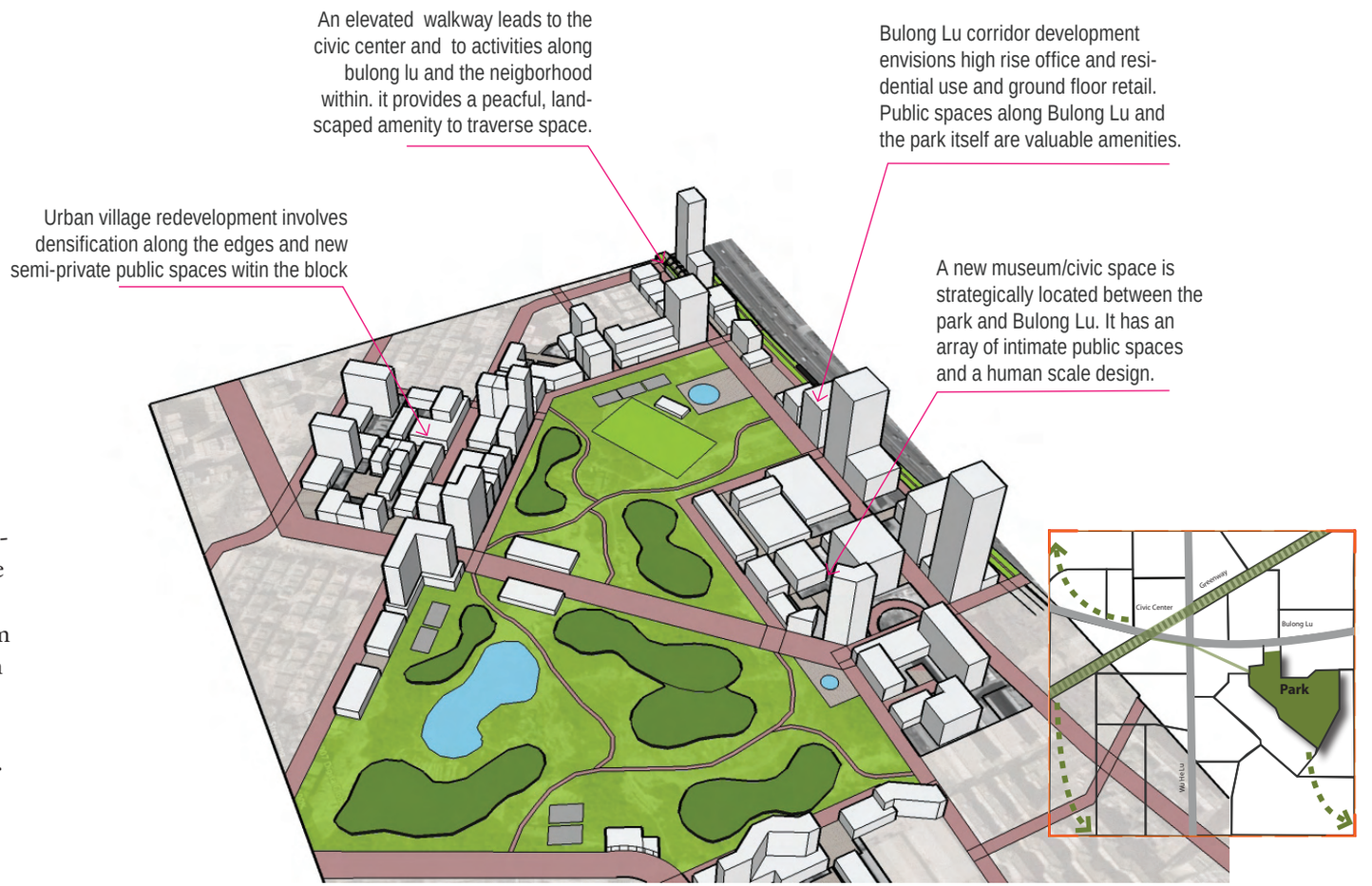
SHENZHEN 24 HA

Urban Park and Edge

ACTIVE, DENSE PARK EDGE

The urban park to be developed in the Intervention Zone will be existing swath of open space filled with lush landscape and vacant cleared land. The vacant space is separated from Bulong Lu by a row of buildings and is bounded by urban villages, bulky housing developments, and industrial uses.

The proposed park includes recreational space and naturalistic space—both programmed and unprogrammed —that are connected to the rest of the district. People can enter the park via an elevated walkway from the civic center, which passes through high-rise complexes, via the commercial corridor along Bulong Lu, or via the adjacent neighborhood streets.

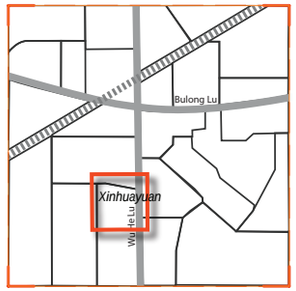


PROPOSAL

Xinyuhuan: A Typical Neighborhood

The development of this 30-hectare neighborhood demonstrates the goals and principles explored throughout this volume. The experience of a future visitor to the neighborhood illustrates the implementation of these principles.

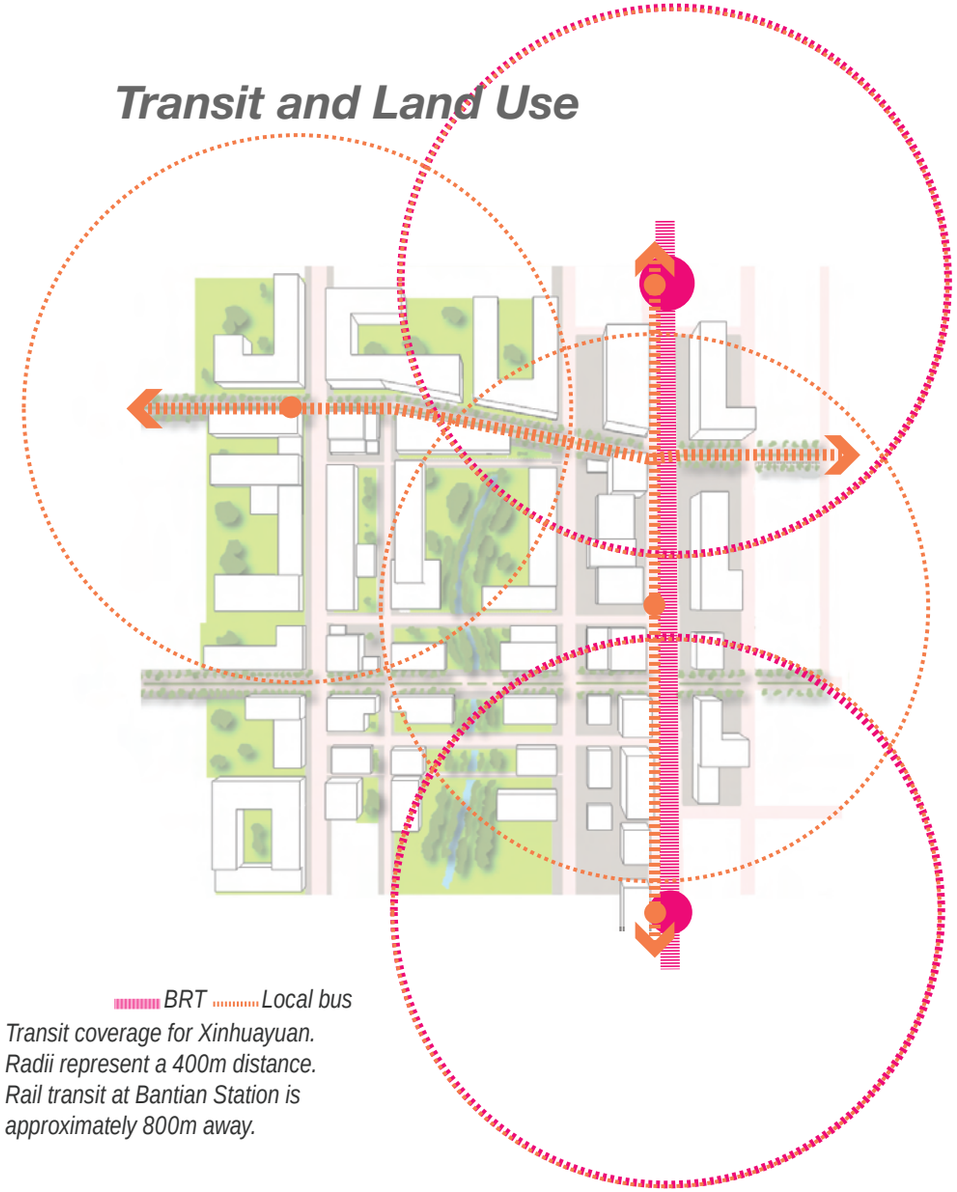
A visitor from outside Bantian will travel from metro station along one of the Wu He Lu bus-rapid-transit (BRT) lines. Alighting a few minutes later at the BRT stop near Shuixiang Lu, our visitor will find herself amidst high-rise residential and office towers with lushly-planted sidewalks full of people walking to and from home, office, shops, and parks. Turning west onto Shuixiang Lu, she will find an inviting, moderately-sized boulevard planted with street trees and a landscaped median. Small-scale shops and restaurants along the boulevard wil buzz with activity. Along Shuixiang Lu she will first see the linear park at the neighborhood's center. Nestled between residential buildings eight to ten stories high, the park will offer a natural experience to the neighborhood. Cyclists, joggers, and walkers will enjoy winding paths during the cooler hours of the day. Nearby office workers will enjoy the view of the park. The local kindergarten and major recreation center will front the park, allowing children and mahjong-playing grandparents to enjoy the verdant surroundings.



Plan view of Xinhuayuan

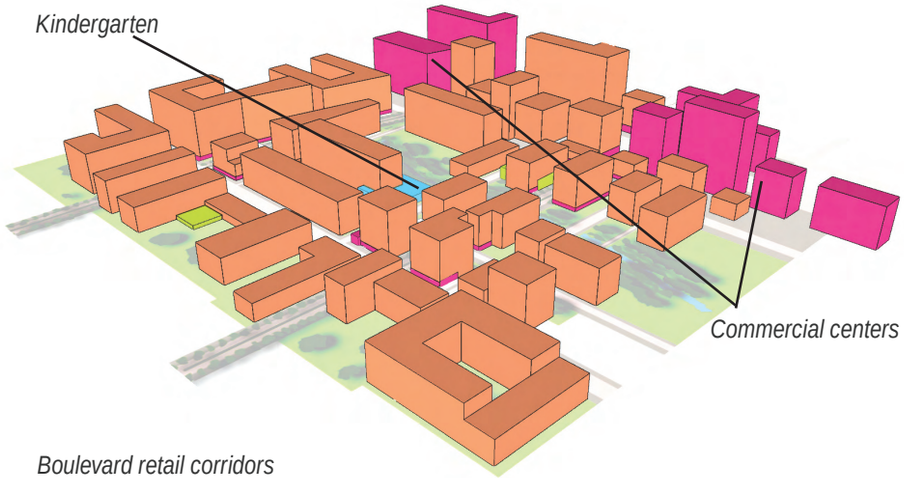
Basic Statistics		*Residential*		*Other*	
Population	13,700	GFA (sq. m)	426,200	Kindergarten GFA (sq. m)	2,800
Land Area (hectares)	30	Average Unit Size (sq. m)	90	Recreation Center GFA	2,600
Total Gross Floor Area (GFA) (sq. m)	517,200	*Commercial*		Structured Parking Spaces	2,900
Average FAR	3	Office GFA (sq. m)	65,600		
Green Space Percentage	20	Retail GFA (sq. m)	16,600		

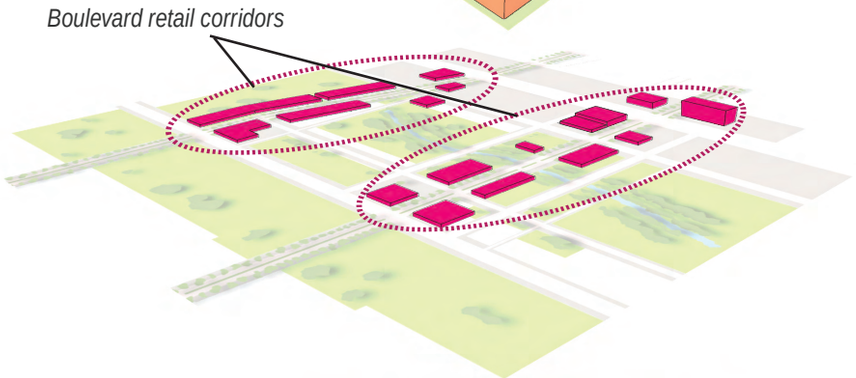
Transit and Land Use



BRT Local bus

Transit coverage for Xinhuayuan. Radii represent a 400m distance. Rail transit at Bantian Station is approximately 800m away.





Residential
Commercial
Educational

Xinhuayuan land use

PROPOSAL

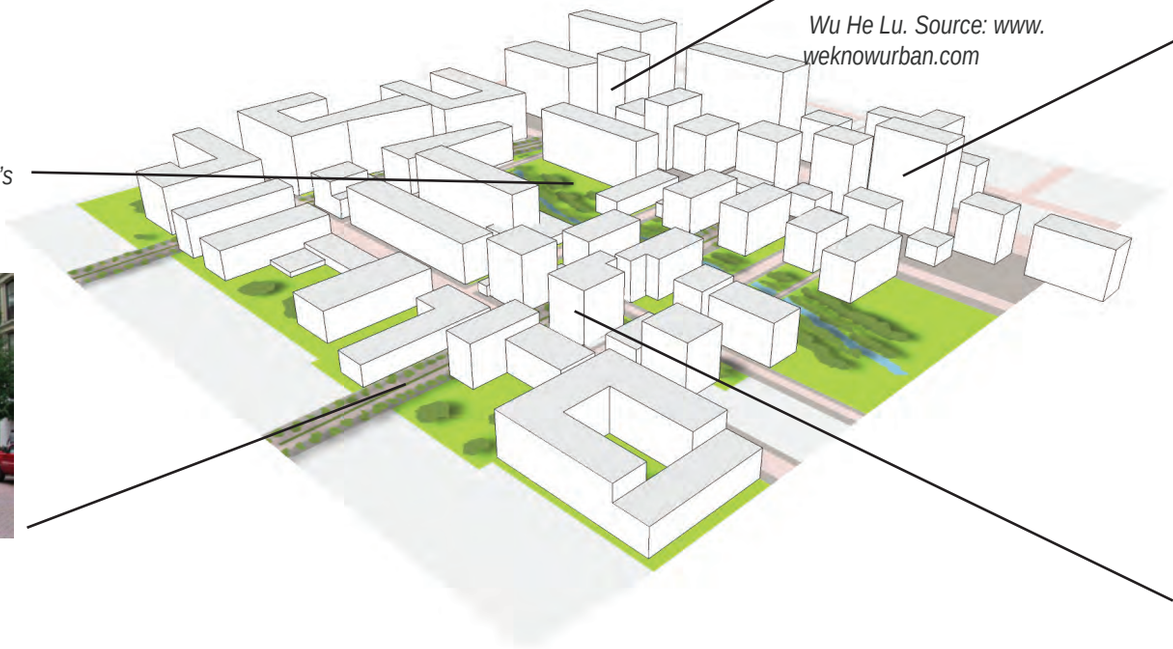
The Look and Feel of Xinhuayuan

Residential buildings along Xinhuayuan's central park. Source: www.skyscrap-ercity.com/showthread.php?t=427180

Xinhuayuan's south boulevard. Source: Jay Hoekstra, www.streetsections.com.

A residential tower on Wu He Lu. Source: www.weknowurban.com

An office tower on Wu He Lu. Source: www.jpr.com/my/ProCom.htm.



Residential tower on Hua Nan Lu. Source: www.whelan.co.uk.

shenzhen_*futures*

Justin Fay
Kristen Hall
Amy Stitely
Claudine Stuchell

BUILDING DIVERSITY

Achieving diversity on the Wonderland site through financing, design, and community building.




INTRODUCTION

Scenario

The goal of designing for diversity is derived from a three-part assessment of Shenzhen's present and future circumstances.

Affordable Housing

Together, unchecked private development and ineffective state assistance have led to a scarcity of affordable housing, particularly in large cities such as Shenzhen. The current high prices of residential real estate make homeownership unattainable for 70% of urban residents, and housing prices are growing at a much faster rate than that of disposable income. The government has responded to the urgent need for affordable housing with a series of provisions and mandates. Therefore, private developers face both a market demand and a policy imperative to build affordable housing.

Density

The relatively low FARs of Shenzhen's residential developments will not be sustainable in the long run because of increasing development costs, explosive population growth, and resource strain. The changing nature of the population suggests a reduced demand for multi-generational housing and an increased demand for smaller units: young people are starting families later, and elderly persons will begin to live independently in greater numbers. Finally, as car ownership squeezes both infrastructure and natural resources, government policies will by necessity favor public transit, which is better served by dense development.

Community

Shenzhen's current demographics are unique, as the average age is 30 and most city residents have migrated from other parts of China. However, its population will stabilize over time in age distribution and income disparity. This process will cause social networks within existing planned developments to solidify, with community becoming increasingly important. Moreover, the aged population is expected to double between 2005 and 2015. Given this picture, it is important to create communities that serve people of varying incomes, ages, and needs.

Purpose and Goal

An examination of these three components – affordable housing, density, and community – has inspired us to improve on all by incorporating greater diversity in residential developments. The implementation of the following measures can achieve these goals:

Affordable Housing

First, a package of four subsidy tools can be applied individually or together to fill the gap of Shenzhen's inadequate affordable housing supply.

Second, this section presents five major mixed-income housing programs that vary by ratio and intensity. The least aggressive of these income-mix programs is then applied conceptually to the existing Wonderland site.

Density

This section explores the use of density to create affordability on a project site. First we look at the problems and benefits of density in China and the United States. We then look into various models of building dense developments and their applicability to China. Applying these models to the Wonderland site constitutes the final element of this section.

Community

Using walking distances, we offer residential site design strategies for accommodating three significant demographic groups: the elderly, families, and young adults with no children. Isolating each demographic group demonstrates how one can strategically locate amenities on the Wonderland site to serve each group's specific needs. Finally, two concept plans illustrate how to integrate all three of these demographic groups reside together on the Wonderland site.

EXISTING CONDITIONS

Wonderland, Shenzhen

Overview

Wonderland was the first large residential project developed by Shenzhen Vanke Real Estate Co. Ltd. Started in 1999 and constructed in phases, the 4,700-unit project was completed in 2002.

Project Statistics:

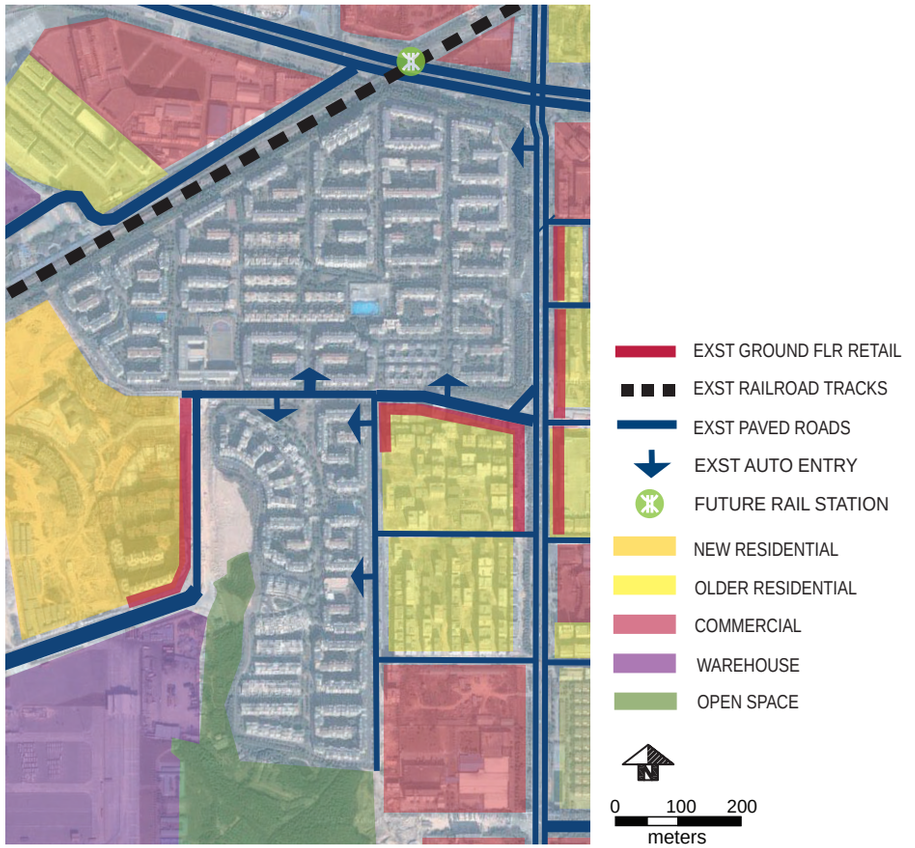
* Location: Bantian town, Longgang District, 10 km north of City Hall
* Site Area: 373,900 sq meters
* Building Area: 544,000 sq meters
* Floor Area Ratio (FAR): 1.45
* Green Ratio: 40%
* Total Units: 4,700
* Total Residents: 17,000
* Resident Profile: Middle Income Earners, Young Families, Extended Families, Independent Elderly

Site Context

Located 10 kilometers north of the city center, Wonderland can be accessed via the main highway to the west (not shown) or the major divided arterial (Wu He Lu) just east of the site. The site is bound to the north by an existing rail line and another major arterial (Bulong Lu).

The city rail is being extended to the district. The future rail stop will be located at the north end of the site at the intersection of Wu He Lu and Bulong Lu.

The surrounding neighborhood is in transition. A new mixed-use, ten story, high-end condo development is currently under construction to the west of the site. Meanwhile, older village-style housing and commercial spaces are located off to the east and west. A danwei live-work compound is just across



the rail tracks to the northwest. A large container shipping facility is located at the southwest corner beside a large tract of green space.

Building activity in the area suggests there will be further demolition and construction. Lots have been cleared. Buildings are going up and land is being re-graded.

Project Site

The composition of Wonderland reflects Shenzhen's recent demographic changes. It is a restricted access community for middle-income earners with a form and density unlike its surroundings. Landscaping, grade changes, roads, and fences ring the perimeter of the site, physically separating the community from its neighbors.

The site is comprised of two parcels bisected by a two-lane road. The most striking design feature of Wonderland is the wide pedestrian thoroughfare off of Wu He Lu. Along both sides of this thoroughfare, storefronts are set back under an arcade with residential units above.

Other community amenities on site include a community center, schools, playing fields, swimming pools, and other parks. They, like the pedestrian mall, are not directly accessible to non-residents.

The housing stock is mostly comprised of six- to nine-story condominium buildings that are arranged in courtyard configurations. There are a limited number of more expensive low-rise blocks, townhouses, and villas, but the bulk of Wonderland's population resides around its active courtyards.

FINANCING AFFORDABLE HOUSING

Introduction

Purpose and Goal

Four different subsidy tools form a package of financing mechanisms that can be applied individually or together to create more affordable housing. These tools aim to fill the gap of Shenzhen's inadequate affordable housing supply.

China's Urban Housing History: Creating and Perpetuating Unaffordability

Since initiating the first of urban housing reforms in 1988, China's government has pursued various policies designed to increase and improve its cities' housing stock, as well as encourage urban development and promote economic growth. Although these policies have undergone many iterations, a central component of reform has been the increased reliance on commercial industry to provide housing. Commercialization has undoubtedly aided China's successful realization of the aforementioned goals, but it has also contributed to a new problem: unaffordable housing.

This phenomenon is particularly painful for a country such as China, which before 1988 considered housing provision a crucial element of social welfare and a valuable capital investment. Housing remained extremely affordable until reforms ushered in privatization, with the government selling its public housing stock and entrusting new development to private companies. By 1994 commercial housing prices had climbed high enough for the government to reassert its involvement, initiating the Housing Provident Fund (Zhufang Gongjijin) and the Affordable Housing Program (Jingji Shiyong Fang), which targeted low and middle income residents. Recent assessments, however, critique these programs for misplacing subsidies as a result of high income thresholds and income-regressive contributions that favor higher earners.[1]

Shenzhen and Wonderland

Scenario

Together, unchecked private development and ineffective state assistance have led to a scarcity of affordable housing, particularly in large cities such as Shenzhen. The current high prices of commercial real estate make homeownership unattainable for 70% of urban residents, and housing prices are growing at a much faster rate than that of disposable income.[2] The ratio of average house price to average household income is 9:1 in Shenzhen, and the World Bank considers ratios above 6:1 as severely unaffordable. With a population whose average age is 30 and a labor pool that is increasingly mobile, Shenzhen faces an increasing demand for more affordable and flexible housing options.[3]

Compiled with real estate statistics from Shenzhen and information about Wonderland the following assumptions guided the simulation of four subsidy mechanisms.

Assumptions for Subsidy Simulations

* Target group for inclusion: Shenzhen's worker population (average workers' income = 80% of population average income)

* Proposed financing scenario for workers: mortgage or rent payment should not exceed 30% of household income

* Proposed affordable/market rate ratio: 20% affordable units and 80% market rate units

* Potential subsidy mechanisms:

- Project cross-subsidy

- Interest rate subsidy

- Rent subsidy

- Land subsidy

Footnotes

1. Yi Xu, "Effects of Housing Policies on Intra-urban Inequality in Transitioning China," (Cambridge, MA: Massachusetts Institute of Technology, 2005 MCP Thesis), 14; 38-9.

2. "Continued Regulatory Tightening: Assessing China's New Residential Property Landscape," CBRE Research Website, January 2007, <www.cbre.com>.

3. Shenzhen Statistical Yearbook (Shenzhen Statistics Bureau: China Statistics Press, 2006).

Achieving Affordability Through Subsidies

Basic Parameters

* Eligibility for affordable housing: those earning less than or equal to 80% of Shenzhen's average household income
* Affordability measure: housing payments do not exceed 30% of household income
* Percentage of affordable units in development: 20%

Project Cross-Subsidy

* Mechanism: impose cap on monthly mortgage payment for eligible affordable housing recipients
* Funding stream: cross-subsidize affordable units by raising prices of market rate apartment
* Policy initiative: a government mandate should require all private real estate companies to provide 20% of all new residential units at affordable rates (as defined above)

Interest Rate Subsidy

* Mechanism: reduce monthly mortgage payment burden by offering mortgages at a subsidized interest rate (for example, 1%)
* Funding stream: subsidy makes up difference between market rate mortgage and subsidized mortgage for eligible households
* Policy initiative: government could provide below-market-rate loans to banks and/or mortgagors, who would then pass the subsidy to eligible borrowers in affordable financing

AFFORDABLE HOUSING FINANCE: SUBSIDY SCENARIOS FOR 100 sq. m UNIT	
Project Cross-Subsidy:	
Affordable Mortgage Payment: Percentage of Workers' HHI	30%
Average Monthly Payment for Affordable Unit	¥1,512
Monthly Mortgage Subsidy Requirement	¥1,176
New Affordable Price/Square Meter	¥3,934
New Market Price/Square Meter	¥10,930
Subsidized Interest Rate of 1%:	
Monthly Mortgage Payment	¥1,800
Percentage of Workers' HHI	36%
Monthly Subsidy Requirement (difference between 5.04% market rate and 1% subsidized rate)	¥1,218

Rent Subsidy

* Mechanism: provide units for rent to eligible household

* Funding stream: rent payments would equal market rate mortgage payments (or fair market rent), and eligible households would pay 30% of their monthly income to meet those rental payments; a government-provided voucher would make up the difference

* Policy initiative: government-provided rental subsidy similar to Section 8 vouchers; government should require real estate developers to offer a minimum number of units to voucher recipients

(For calculation example, see interest rate subsidy above)

Land Subsidy

* Mechanism: provide land at reduced or negligible cost for the construction of affordable housing units

* Funding stream: government, developer, or a partnership between the two subsidizes land allocation; to maximize the return on this subsidy, development will likely assume a relatively dense form

* Policy initiative: because China's government already allocates land to state enterprises and institutions, it could easily extend this subsidy to private developers as an incentive to construct affordable housing.

When China instituted land reforms, it allowed the transfer of land use rights, thus ascribing value to land and treating it as a factor of production. These reforms, however, have not constituted a complete marketization of land.

It is difficult to simulate this subsidy tool using Wonderland's parameters or other hypothetical parameters because hidden transaction costs obscure an accurate cost-benefit analysis of a project. When used appropriately, a land subsidy should be reflected in project appraisals with the true market cost of land use rights, but the system of land allocation in China has complicated such transparency. When enterprises receive land allocations at very low prices, they often illegally sell those land use rights at far higher prices on the secondary and tertiary markets, making it difficult, if not impossible, to accurately price land in China.

In its set of affordable housing measures announced in 2006, the government demonstrated a new commitment to changing this system, vowing to promote transparency and market efficiency, as well as rectify unlawful practices in land transactions and property development.

CASE STUDY: SUCCESSFUL FINANCING

Tent City, Boston

Overview

Located in Boston and completed in 1990, Tent City is a residential complex serving mixed incomes and mixed uses. It provides an extraordinary example of successful financing because 25% of its apartments are market-rate, while the other 75% are offered at affordable rates to low- and medium-income families. Public-private cooperation helped achieve this financing structure.

Location

Tent City is situated in downtown Boston at a commercial, residential, and transportation hub. It abuts other housing with varying income levels as well as Copley Place, an upscale shopping mall.

Tent City, Boston.
Source: Goody Clancy

Financing

Financing came from 13 different sources to fund the $36 million project.

* Grants: two grants from the Boston Redevelopment Authority funded site and street improvements ($673,000)
* Mortgages: Massachusetts Housing Finance Agency provided three tax-exempt mortgages at 9.5% interest ($673,000)
* Equity Funds: Limited equity partners pay $10 million of funds over period of 7 years; these funds pay for development costs, create a reserve, and repay a bridge loan
* Rental Subsidies: four different federal, state, and city programs pay rental subsidies for tenants

Development Cost Breakout

* Construction: $29,409,000
* Construction loan interest: $2,000,000
* Financing fees: $1,088,000
* Taxes and insurance: $110,000
* Design fees and surveys: $1,900,000
* Professional fees: $1,125,000
* Marketing and rent-up: $275,000
* Staff costs: $75,000

Design

Tent City's design consists of two main structures:

* 12-story structure contains 176 one- and two-bedroom units and 6,500 square feet of ground-floor retail space
* 4-story townhouse contains 93 three- and four-story bedroom units

The development has an FAR of 2.3, and the total site area is 140,180 square feet.

Lessons from Tent City

Supportive political leadership, active community groups, and a booming real estate industry helped make the public-private partnership successful. Tent City is a high-quality, financially viable, and diverse development. It is important to note that even though the 50% moderate income tier alleviates pressures from extreme income mixing, this structure is more difficult for financing, because subsidies target more low-income families.

MIXED-INCOME HOUSING

Program and Design Guidelines

Mixing against the Market Economy

Cities operating under the free-market economy tend to spatially and socially subdivide by class, thus creating zones of wealth and zones of poverty. Shenzhen, China's first established SEZ, is no exception to this phenomenon.

Housing developers are reaping the benefits of the city's rapid growth, maximizing profits by selling to the emerging middle and upper class. New residential compounds cater to the newly wealthy, capitalizing on their desire for more exclusivity, security, and homogeneity.

Those who cannot afford to buy into these compounds resort to occuping other spaces in the city. The result is income segregation by block, neighborhood, or district.

Mixing as a Strategy for Social Stability

Mixed-Income Housing is currently the preferred American strategy for countering such segregation and its associated social ills. Backed by national and state policy-makers, Mixed-Income Housing forces a level of neighborhood diversity that would otherwise never be achieved in a market economy.

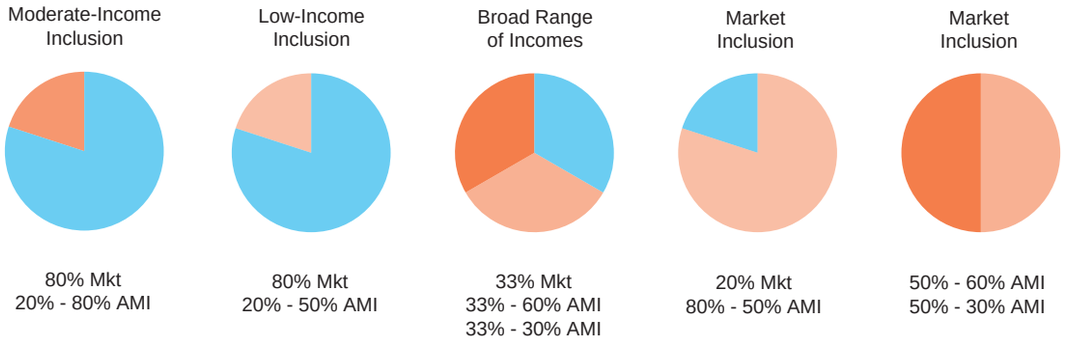
A wealth of literature supports the fact that diversity promotes economic health for a society. Metropolitan economies perform better better where city and suburb have less income disparity. Interaction or the opportunity for interaction among diverse peoples is believed to be a necessary part of overcoming some social problems. Diversity helps build social capital and bridges networks across formerly segregated groups.

100% Market Rate

100% Low Income (Subsidized)

Category	Description	Unit - Income Mix	
		% Units	% of AMI*
Moderate-Income Inclusion	Predominately market-rate units with 20% for moderate-income households	80%	Market
		20%	80%
Low-Income Inclusion	Predominately market-rate units with 20% for moderate-income households	80%	Market
		20%	50%
Broad Range of Incomes	Serves market-rate, moderate/low-income, and extremely low-income households equivocally	33%	Market
		33%	60%
		33%	30%
Market-Inclusion	Serves predominately low-income households with 20% market-rate units	20%	Market
		80%	50%
Affordable Mix	Serves moderate/low-income and extremely low-income households	50%	60%
		50%	30%

*AMI – Area Median Income



How much Mixing? What Scale and Degree

Mixed-Income Housing developments vary along the following measures:

* Scale & degree of income mixing
* Amount of spatial integration across income levels

There are five major classifications of income mixes as shown in the adjacent table. They occur on a continuum of less aggressive to more aggressive formulas, as projects range from 100% market-rate to 100% low-income.

To determine which of these five income mixes is most appropriate for a site, a developer must carefully consider the contextual real estate market of a project, as well as the motivations for mixing. Further information on applying these five mixes is below.

How much Mixing? Spatial Integration

Mixed-income housing can be applied at the district, site or the building level. There are an infinite number of methods for spatially distributing affordable units across a project area. They occur along the spectrum between these two extremes:

* Highly concentrated: Designating an entire building or cluster of buildings as "affordable" within a medium- or large-scale site.

* Highly dispersed: Evenly distributing "affordable" units within all buildings on a site.

The highly concentrated model has worked well at the district level in the New Towns of Singapore and Hong Kong, but it has been less successful in some cases in the United States.

American policies at the state and national levels currently favor the highly dispersed method. In the most equitable projects, affordable units are scattered uniformly throughout a district, neighborhood, site or building.

Applying a Mixed-Income Strategy for Wonderland

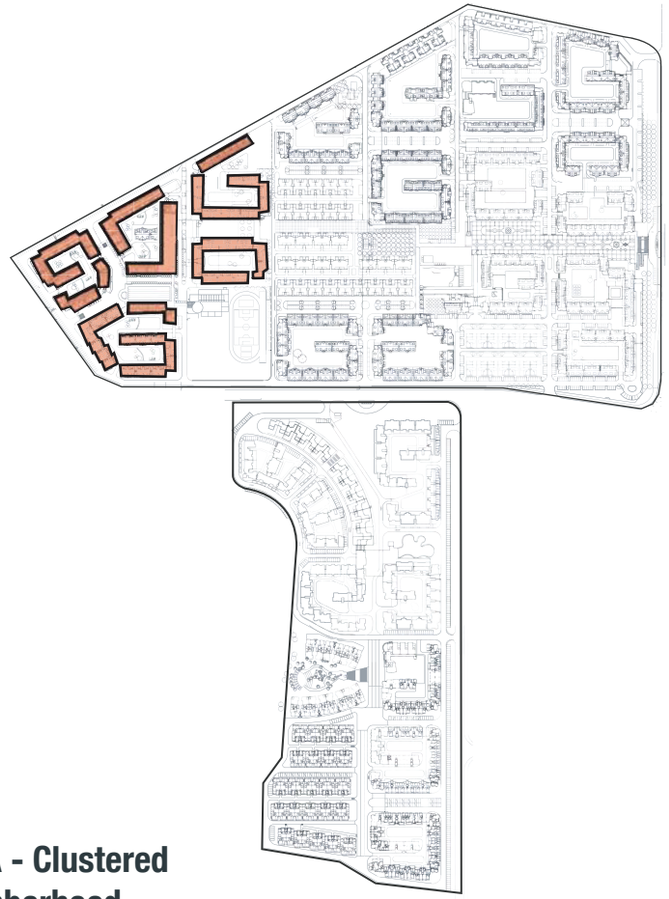
Using Vanke's existing Wonderland site as an example, we tested the implications of employing the two least aggressive mix strategies. Both the Low- and Moderate-Income Inclusion methods apply an 80/20 percentage mix, where 20 percent of the units are designated as affordable.

Applying an 80/20 mix, the Wonderland site requires that 967 of the 4,834 units be designated as affordable. There are several options for spatially distributing them across the 37.4 hectare site.

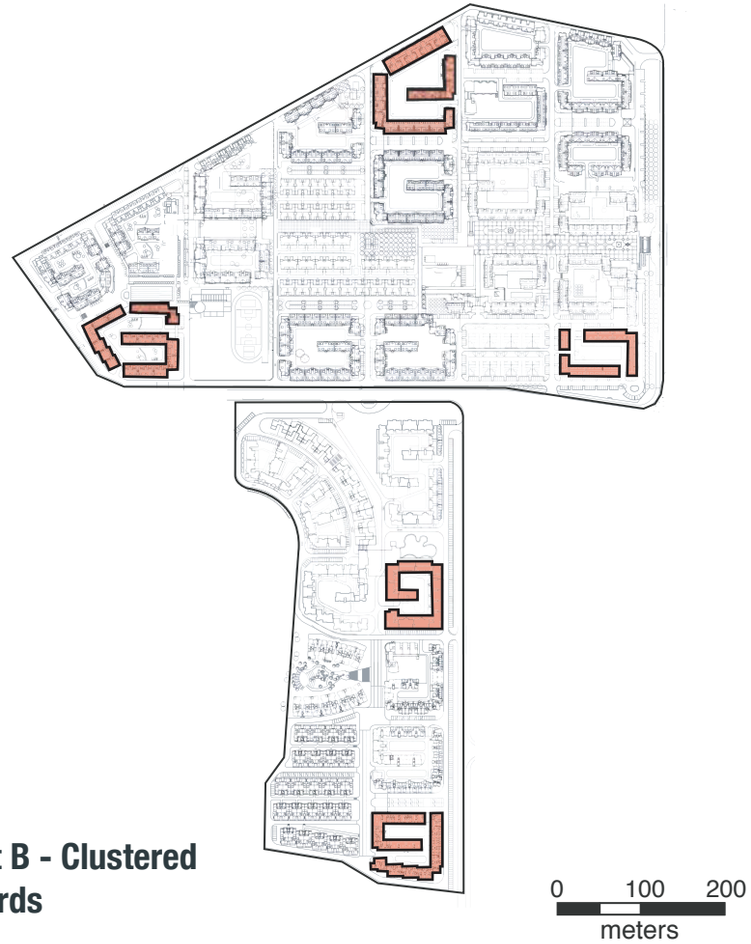
Highly Concentrated Models

Concentrating low-income earners in "affordable" units allows for lower-income earners to build networks among themselves. However, over concentration can physically isolate low-income residents and deter them from forming social bridges with the rest of the community.

Concept A and B show two options for concentrating "affordable" units on the Wonderland Site. Option B is the more moderate approach, providing low-income earners their own courtyards, and then distributing them across the both parcels of the site.



Concept A - Clustered Sub-neighborhood



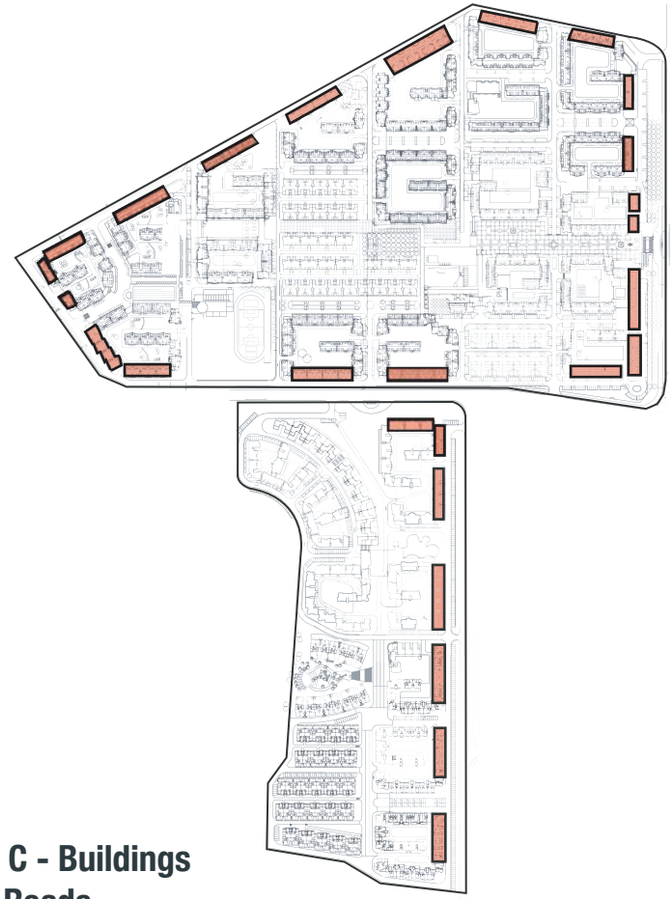
Concept B - Clustered Courtyards

Dispersion Models

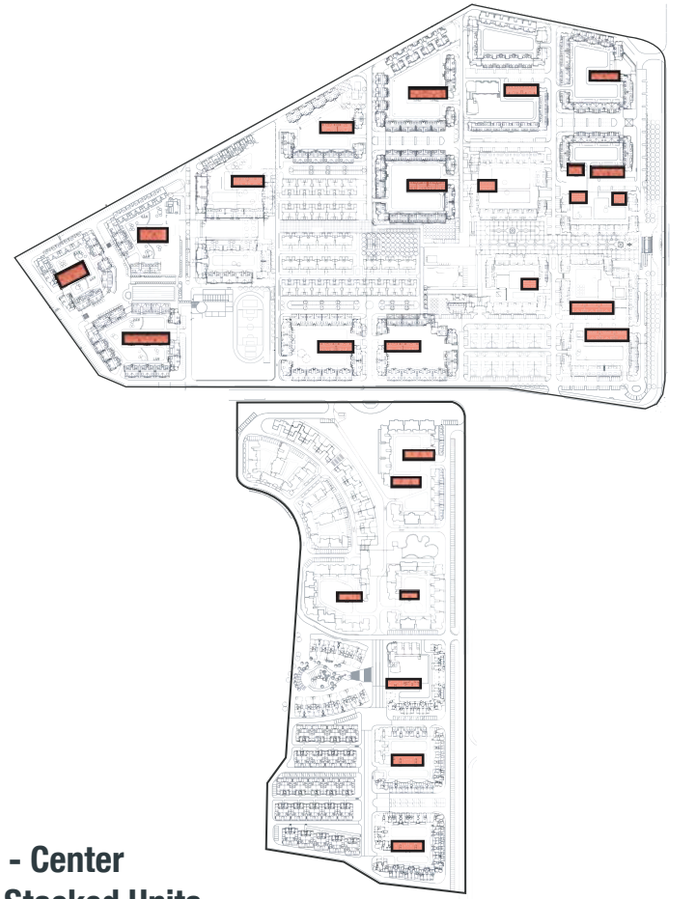
Though it is less efficient for the builder and the management, designers of American mixed-income communities are currently favoring the dispersion method for distributing "affordable" units across a site. It is seen as a more equitable solution and assumed to be better for bridging social networks across diverse populations.

Option C designates edge buildings as "affordable." This approach assumes that real estate is more valuable in the center of the site because it is off of the busy arterials.

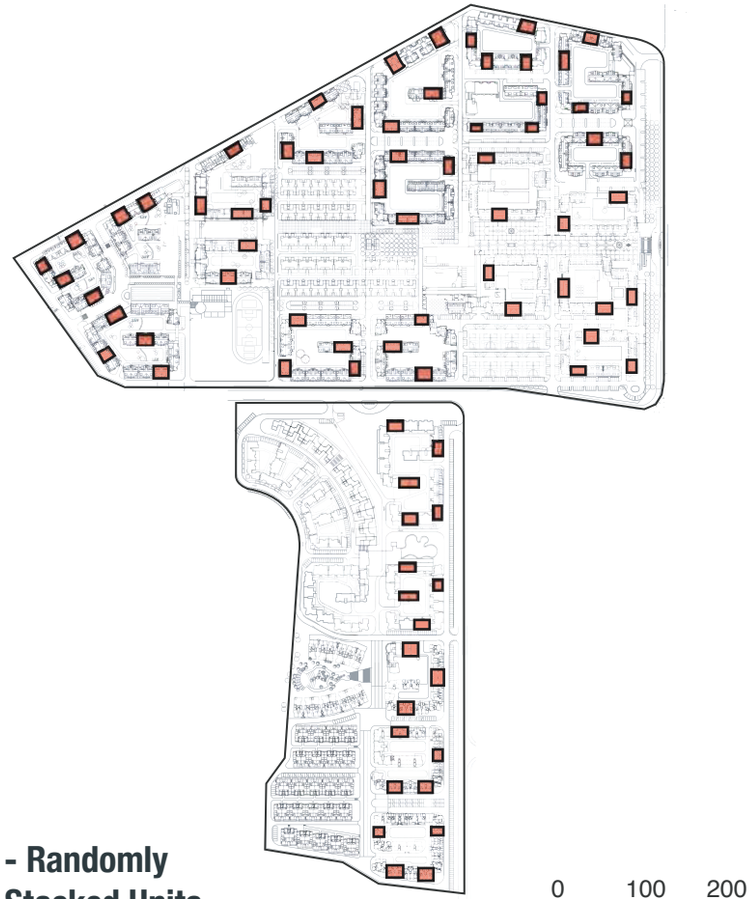
Options D and E designate different stacks of units as "affordable." In Option D affordable units are placed at the inner courtyard, while Option E employs a random selection method.



Concept C - Buildings by Busy Roads



Concept D - Center Courtyard Stacked Units



Concept E - Randomly Dispersed Stacked Units

0 100 200
meters

DESIGNING FOR DIVERSITY

Achieving Affordability with Smaller Dwelling Units

Historic Context

The Chinese urban landscape has transformed over the past twenty-five years. With this transformation, the size of the average dwelling unit has risen dramatically. In 1980, most of China's urban population lived in low-rise buildings or 8-storey walk-ups. A study of housing in Guangzhou reveals that average per capita living space in 1980 was only 3.97 square meters. By the beginning of the twenty-first century, Guangzhou's average per capita living space had more than tripled, reaching 13.87 square meters by 2001.

Changes in family living arrangements have greatly impacted housing patterns. Historically, intergenerational co-residence has been viewed as a realization of the cultural ideal of "five generations under one roof." Since the late 1980s, family division and individual living have been occurring earlier and earlier. Regardless of which generation does the actual moving, the motivations are similar: a desire to control one's own daily life, to eat what and when one chooses, to hear or watch one's own selection of radio or television programs, to not feel like a servant in one's own home, or simply to enjoy peace and quiet.

Since the 1950s, multigenerational living in cities has emerged from several potential factors, including lack of housing availability, economic need, and/or the desire for "family warmth." Consequently, researchers have assumed that the increased availability of urban housing will allow Chinese families greater latitude to choose the type of living arrangements they prefer. Given this trend, it is likely that the proportion of multigenerational households will decline in the future, resulting in an increased demand for a diversity of dwelling unit sizes and configurations.[1]

Financial Model

Mechanism: increase affordable offerings with the construction of smaller units

Funding stream: residents make full mortgage payments because the price of smaller units would not exceed 30% of their household income

Policy initiative: in 2006 the government introduced the "70/30" measure, stipulating that 70% of new residential construction must consist of units 90 square meters or less; government should advocate for more construction of even smaller units.

Shenzhen Parameters:

Average price/sq. m of housing in Shenzhen	¥6,996
Typical down payment	20%
Government-determined affordable interest rate	4.05%

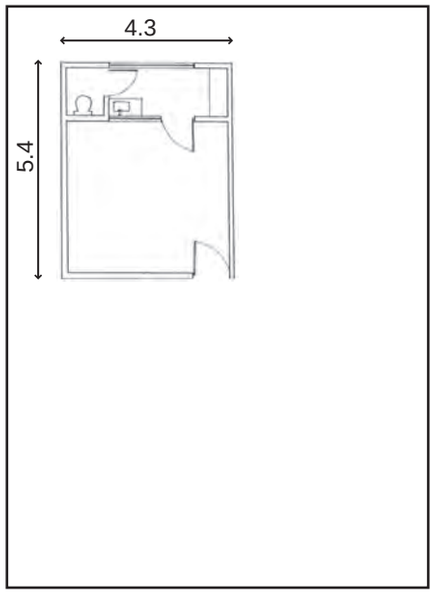
Mortgage Simulations for Smaller Units

Unit Size (sq. m)	Monthly payment on 30 year mortgage	Percent of Workers' Monthly HHI
30	¥806	16%
40	¥1,075	21%
50	¥1,344	27%
60	¥1,613	32%

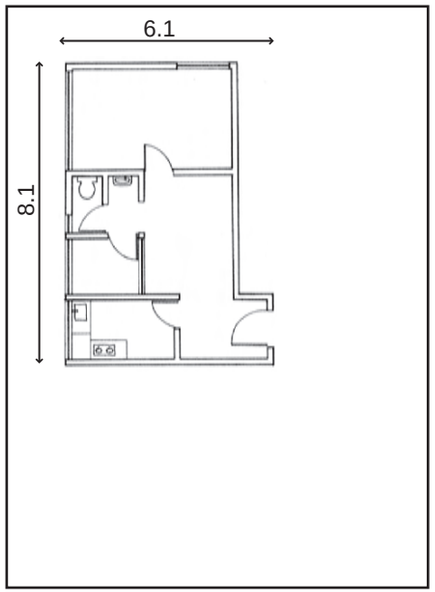
1. Historic Context based on: Ikes, Charlotte. The Impact of Housing Policy on China's Urban Elderly. The Institute, Inc. 2004.

2. Images A & B: Rooney, Nuala. At Home with Density. Hong Kong: Hong Kong University Press. 2003.

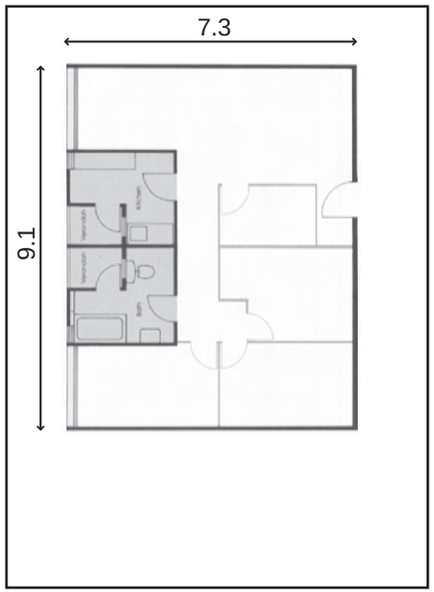
3. Image C: Ng, John, Stephen Tong, Edwin Yim, and W.V. Coffey, eds. Portfolio of Works: Hong Kong Housing Authority – Construction Branch & Housing Department. 1986.



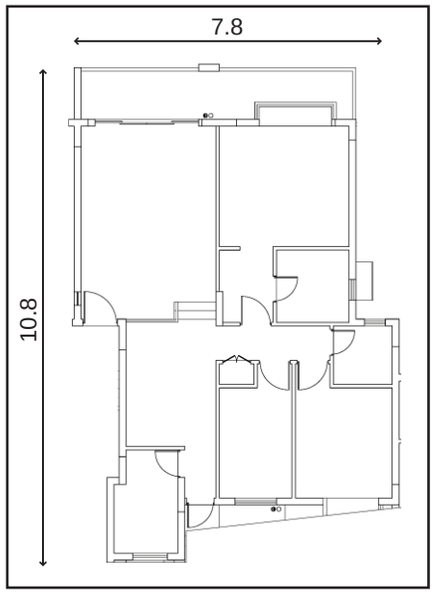
Size: 23 square meters (4.3x5.4)
Type: Studio
Typical capacity: 3-4 people
Building type: Slab block
Location: Hong Kong
Developer: Hong Kong



Size: 50 square meters (6.1x8.1)
Type: 2-bedroom
Typical capacity: 7-9 people
Building type: H-block
Location: Hong Kong



Size: 66 square meters (9.1x7.3)
Type: 3-bedroom
Typical capacity: unknown
Building Type: New slab
Location: Hong Kong



Size: 84 square meters (7.8x10.8)
Type: 2-bedroom
Typical capacity: 3-5 people
Building Type:
Courtyard building

DESIGNING FOR DENSITY

Introduction

Hong Kong

Hong Kong has planned carefully to concentrate development into compact buildable areas. This strategy has allowed the city to maintain a large open-space network, while focusing development around transportation nodes. The public transit network is highly efficient and heavily used. At an average density of 2,700 persons per hectare, high rise buildings are the only viable building typology[1]. The result is that Hong Kong is home to some of the smallest units of any major city, and there are few private outdoor spaces.

Shenzhen

The development of Shenzhen has been less cohesive than that of Hong Kong. While there is a defined urban center, there are many differing types of development across the city. Some areas are more suburban, which is characterized by lower density, dispersion around transit nodes, distinct land use areas, and greater car dependency. These conditions differ greatly from the typical form of Chinese urban development, which tends to be more dense with a variety of land uses distributed throughout neighborhoods.

Wonderland

The Wonderland development follows this more suburban pattern of development. At a floor area ratio (FAR) of 1.45, this site has a much lower density across the entire site than most of the urban fabric of Shenzhen. This feeling of lower density appears to be a favorable design element amongst the retirees and families who live in Wonderland. It is based on a "courtyard" pattern of development in which about 200 units are arranged around an inner courtyard. In addition to the courtyard developments, there are also mid-rise apartments and attached townhouses.

Each of these images are taken from an altitude of 6,170 feet.

Source: Google Earth

Making Density Work for Affordability

One way to maximize profits on a site is by increasing density. By building to maximum building heights, the developer can achieve the largest profit from the land. Building more densely around specific nodes, including public transit stations, downtown areas, and employment and retail centers, can maximize the efficient use of the land.

Density can serve as a tool for creating affordable housing through three specific ways:

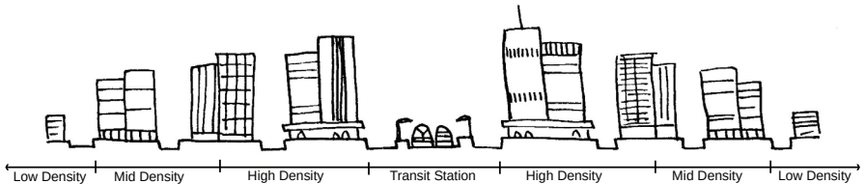
* The economic theory of supply and demand states that by increasing the supply of a commodity, it lowers the price, and therefore makes it cost less.

* Increasing the number of units yields greater profits to developers (to a point) and creates a margin of profit. This margin can create a project cross-subsidy to pay for the affordable units. Furthermore, the developer can create high end apartments through the use of higher end materials at a relatively low cost. The profit gained from these high end apartments can be used to supply the project cross subsidy, while at the same time allowing the developer to differentiate her high end product.

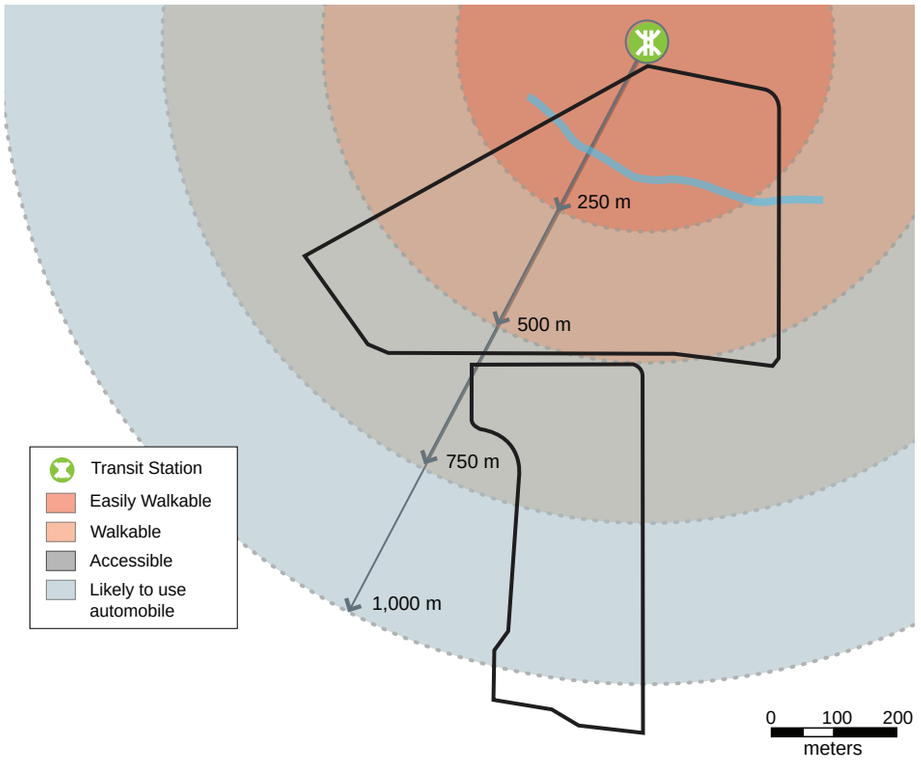
* High density developments allow the developer to create more flexibile unit configuration. This flexibility permits the developer to supply a larger variety of housing options that can cater to both lower and higher income residents.

Models for Developing Density

One way to maximize profits on a site is through the increase of the density. By building maximum building heights, the developer can achieve the largest profit from the land. You can maximize the efficient use of the land through building more densely around specific nodes, including public transit stations, downtown areas, and employment and retail centers.

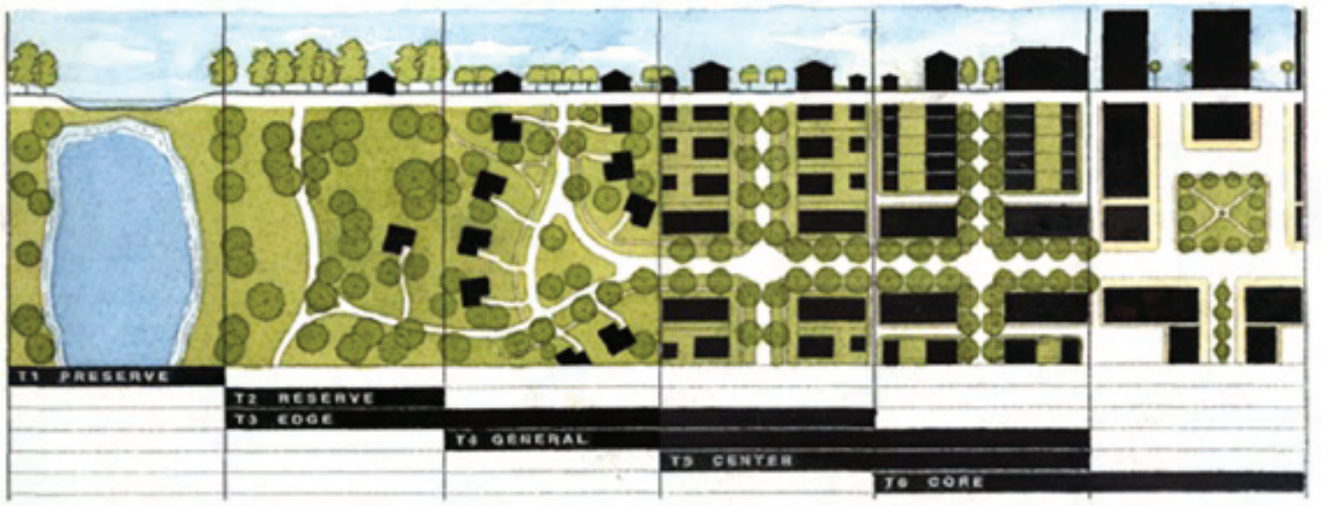


This diagram roughly demonstrates the relation of density to transit.



As housing is developed further away from the transit station, the density decreases. This creates a larger volume of people who can easily access the transit, while locating cars towards the periphery, where there is more room for parking.

Another model of development that incorporates different levels of density is the Duaney Plater-Zyberk transect, which takes the same idea as transit oriented development and applies it to the built form using a visual representation of the densities achieved in different zones. The zones move from urban to rural, and gradually the buildings step down in height and spread out from each other as they move toward the rural areas. This model was fashioned after American densities and thus would not be appropriate for China, which would require a denser urban or hyper-urban zone. Regardless, the idea of stepping down density in different development zones remains salient.



The DPZ transect illustrates visually how density is decreased through the built form. In a country with densities such as China's, the "urban" areas would be much denser than the one pictured here.

(Source: www.dpz.com)

Building Density into Wonderland

Building Types

After understanding the costs and benefits of density and using the various models of densification, we can try to apply these models to the Wonderland site towards the goal of creating affordable housing.

Wonderland has a variety of building types which consist of midrise apartment buildings, townhouses, and villas. The dominant building type is the G-shaped courtyard, which has roughly 200 two- and three- bedroom units in each courtyard. By adding single bedroom or studio units to the mix, it is possible that these smaller units would provide a more affordable option. Furthermore, by adding a range of building types, this large site could become more diverse in its form, with areas that are more or less urban feeling.

The three schemes shown at right can be mixed in any variety of ways to achieve maximum affordability. The proposed locations are based on the concept plan for the future of the district, which posits that there will be more development surrounding the site, and connections through and around the site will become more significant in the changing urban context. These drawings depict a set of ways that Vanke could adapt the Wonderland site through selective demolition, replacing some buildings with other building types.

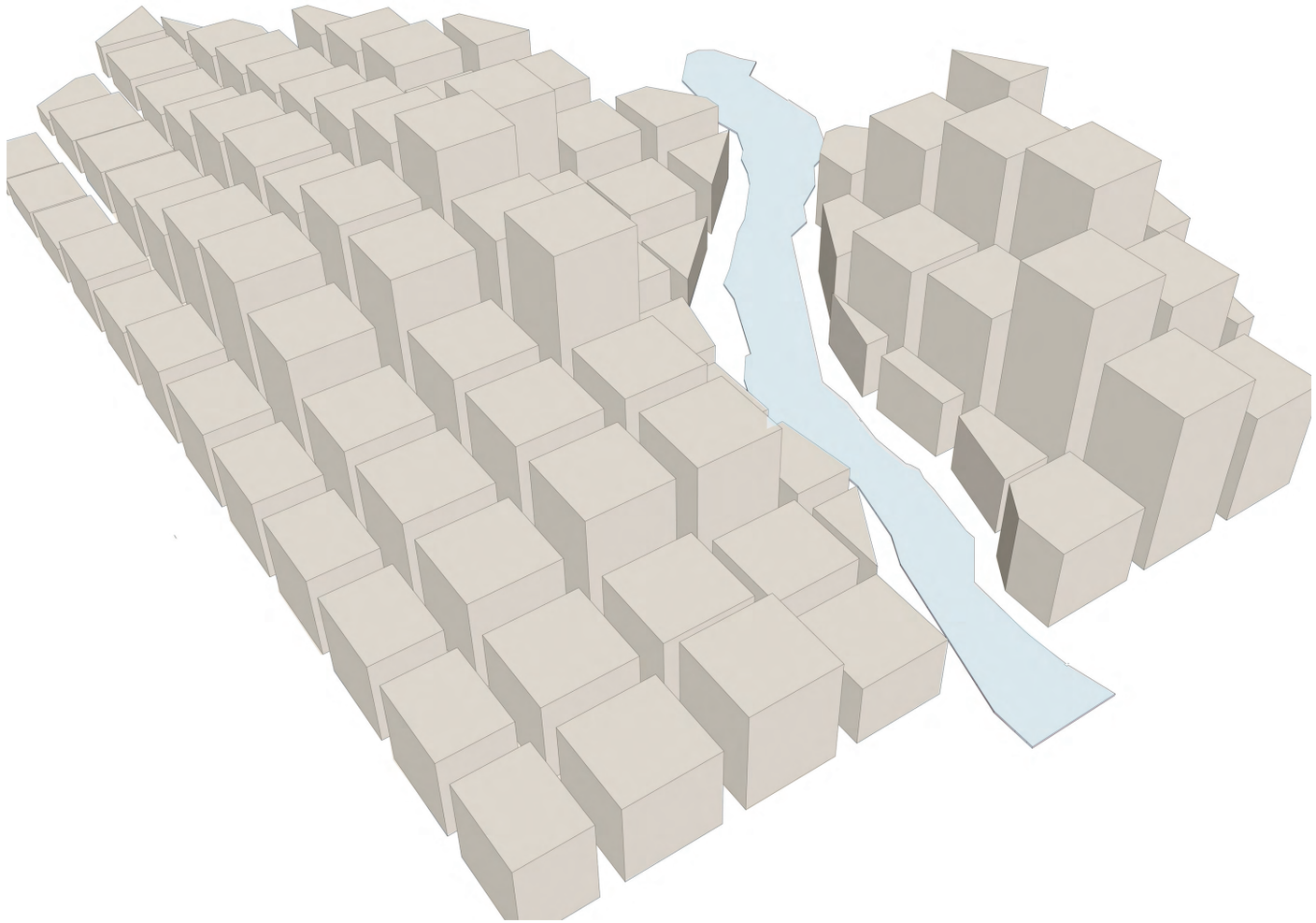
This image depicts a level of ground floor retail with single bedroom residences above. This design would take advantage of the steep slope at the front of the site which currently lifts the site up and away from the sidewalk and street activity. This element could reduce the need for gating, as it creates is own barrier for the site, while still interacting with the street.

This image shows an arrangement of towers at various locations around the site. The towers can be used to create one- and three-bedroom units to add to the two-bedroom units which dominate the housing stock on the site. Towers can be placed at important junctions to punctuate entrances, and they could also include an office component. They would not need to rise above 20 stories, although they could probably go as high as 30 stories.

This image modifies one of the current building typologies increasing it to twelve floors to allow for higher densities. Likely places for this intervention would be on the existing G-shaped courtyards, especially to the north edge of the site by the railroad tracks. If affordable housing were located at the periphery of the site, this typology would serve that dispersion well.

Overall Density Distribution

In the future, a site of similar size and proximity to transit nodes, the site could be developed according to the models discussed here. This site might look very different than it does now, especially in the northern half of the site, which is most accessible to the transit station. The image shown here is a rough building massing that could be applied to the north of the site. The amenities considered here are the transit station and the possibility of reinstating the previously existing river through the site. The building height steps up towards the station, and steps down towards the river to allow views. By arranging buildings on a grid where the corners of buildings are oriented towards the river, we create more units with river views.



Problems and Benefits of Density

Density has traditionally been very high in Chinese cities, especially compared to countries like the United States. While Chinese cities remain dense, on average people in China now have over three times the amount of space per person than they had while living in worker housing.[1] This development has everged from to a marketization of real estate, where people are albe to buy housing based on their powers of consumption. However, this model tends to benefit few to the detriment of the majority.

Low density has prevailed in many American towns largely as a result of consumer preferences, and these market decisions have negatively affected the landscape. People are segregated across great distances by race and class. Wealthier people tend to live in suburbs and those who cannot afford to live in the suburbs are forced to live in inner cities with the access to transit and jobs that they need . Because the wealthy people live in areas outside the city, high property taxes paid by residents of these areas are of no benefit to city dwellers. Thus, transit suffers from under-funding, the environment suffers from high car usage, and the urban poor suffers from concentration in poor urban areas.

Despite the clear problems of low density development, consumers still prefer more suburban environs because of the glut of private space. This feeling of private space can still be created in urban settings with a hierarchy of public to private spaces, which Vanke has mastered with courtyard and terracing. Incorporating this type of thoughtful design into higher density environments can lower the perceived density.

References

1. Ikes, Charlotte. The Impact of Housing Policy on China's Urban Elderly. The Institute, Inc. 2004.

VISUALIZING DENSITY

Housing Case Studies

This visual scale represents different housing densities around the world. Projects were selected not only to demonstrate the range of density, but to address specific issues of ventilation, solar orientation, communal open space, and vertical circulation. The numbers included in this table are based on the number of people per hectare by the project boundary.

Density: 80-120 p/ha

Density: 120-150 p/ha

Density: 200-300 p/ha

net
gross

0 100 200 300 400 500 600

MUHLEHALDE TERRACE HOUSING
Architect: Metron
Location: Umiken, Switzerland
Density: 87 p/ha

EICHLER HOMES
Architect: Ashen & Allen
Location: San Francisco Bay, USA
Density: 140 p/ha

BORNEO/SPORENBURG
Masterplan: West 8
Location: Amsterdam, Netherlands
Density: 400 p/ha

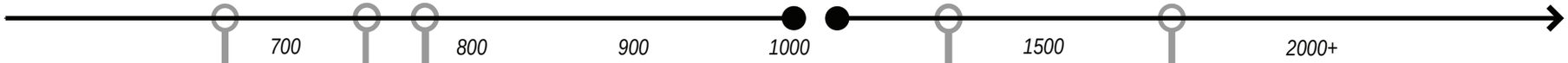
NINGSHUI ESTATE
Location: Shenzhen, China
Density: 518 p/ha
(half scale)

WONDERLAND
Location: Shenzhen, China
Density: 540 p/ha

Density: 200-300 p/ha

Density: 400 p/ha

Density: 2000+ p/ha



YUANLING ESTATE
Location: Shenzhen, China
Density: 650 p/ha
(half scale)

LANGHAM COURT
Architect: Goody Clancy Architects
Location: Boston, USA
Density: 743 p/ha

RUE DES SUISSES
Architect: Herzoz & de Meuron
Location: Paris, France
Density: 759 p/ha

DE MEAUX
Architect: Renzo Piano Workshop
Location: Paris, France
Density: 1315 p/ha

RUE DU CHEVALERET
Architect: Henri Ciriani
Location: Paris, France
Density: 1688 p/ha

ONE HECTARE: 2.47 ACRES
: 10,000m^2

“Free Parcels,” Borneo/Sporenburg, Amsterdam, Netherlands

The 23-hectare Borneo/Sporenburg urban development on the outskirts of Amsterdam maintains a density of 400 people/hectare. The typical low-rise, high density units are 16m deep, 9.5m high along the street. They are organized around an internal light-well, which provides both light and air in the compact planning. The development also maintains a variety of project-based densities, ranging from less dense “townhomes” to the more typical apartment buildings.

Image source: Architecture + Urbanism, May 2002.

“44 Dwellings,” Borneo/Sporenburg, Amsterdam, Netherlands

Also located in Borneo/Sporenburg, this project utilizes a variety of apartment layouts to promote mixed family units. Again organized around a light well, the apartments let in light and breezes throughout the day. The street facade maintains a repetitious but intimately scaled rhythm. These units utilize adjacent street parking.

Image source: http://www.faro-architecten.nl/

Langham Court, Boston, USA

Langham Court is a mixed-income, 84-unit housing complex adjacent to downtown Boston. Its relationship to the existing street edges blends into the surrounding historic district. Historic elements are incorporated into the design to build upon the existing neighborhood character. The interior courtyard allows sunlight into the interior units and hosts a variety of community driven events. Underground parking is accessed through ramps at one end of the courtyard.

Image source: http://www.goodyclancy.com

Eichler Homes, California, USA

The Eichler Homes became popular in the 1950s and 1960s in California for taking advantage of the mild climate of the region. The houses would feature a central outdoor atrium which is both an entrance garden and an organizer of the interior space (most rooms face the courtyard). The garage was typically pulled into the house structure to de-emphasize it from the street view. The backyard was extensively landscaped to optimize its use.

Image source:

Adamson, Paul, and Marty Arbunich. Eichler: Modernism Rebuilds the American Dream. (Salt Lake City: Gibbs Smith, Publisher), 2002.

Muhlehalde Terrace Housing, Umiken, Switzerland

The parallel rows of 3 bedroom, L-shaped patio houses are organized on each side of a central stair. A tram connects a public entrance and parking at the bottom of the hill with the dwellings at the top of the hill. The inclined elevator stops at every third level where there is a lobby in a two level structure. This housing typology falls outside existing models for public or social housing. Due to the expense of in situ concrete construction, it may be more suitable for middle income residents.

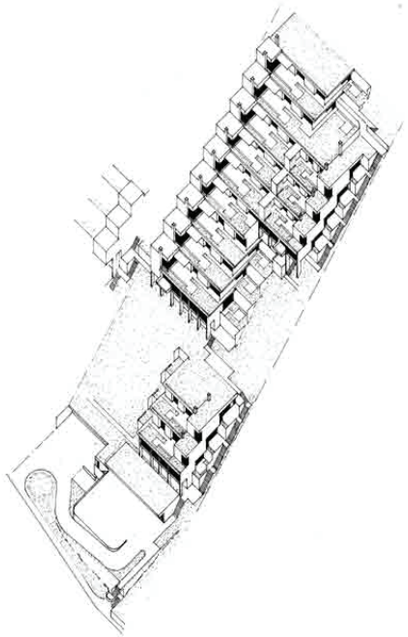


Image sources:
http://www.housingprototypes.org

Rue Du Chevaleret, Paris, France

The main characteristic of this 9-story building that completes the chamfered block of a block is the vertical circulation. The elevators stop every two floors and serve a row of flat units and a row of duplexes that feature a double height ceiling space at the living room. The ground floor is used for retail stores along the corner. The project also counts with two floors of underground garage.

Image sources:
http://www.housingprototypes.org
http://www.wikimapia.com

Rue De Meaux, Paris, France

This courtyard group of 220 apartments is an infill project responsive to the existing context. The height and alignment of the neighboring buildings are respected and the new project is divided into discreet elements that refer the original parcelization of the block. The creation of an inner landscaped garden court is derived from the typical block typology- solid along the street with open space on the interior of the block.

Image sources:

http://www.greatbuildings.com/buildings/Rue_de_Meaux_Housing.html

http://tenplusone.inax.co.jp/archives/fieldwork/photoarchives/0405/031.html

Rue Des Suisses, Paris, France

The project focuses on rebuilding the typical perimeter blocks of Paris, putting smaller flats in the infill buildings and organizing the family dwellings together in the garden area. The infill buildings are built to the neighborhood height of 7 floors, while the interior slab is only 3 floors in height. The long narrow block is designed as a free-standing element in a long narrow garden and is protected with curving rolling wooden blinds that are in sharp contrast to the folding metal blinds that cover the facades of the street buildings.

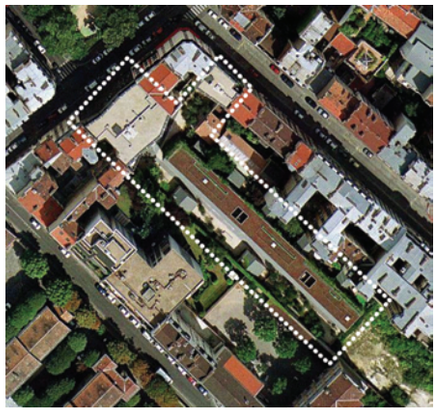


Image source:

http://www.housingprototypes.org

CASE STUDY: BUILDING TYPES AND DENSITY

Four Generations of Public Housing in Hong Kong

Introduction

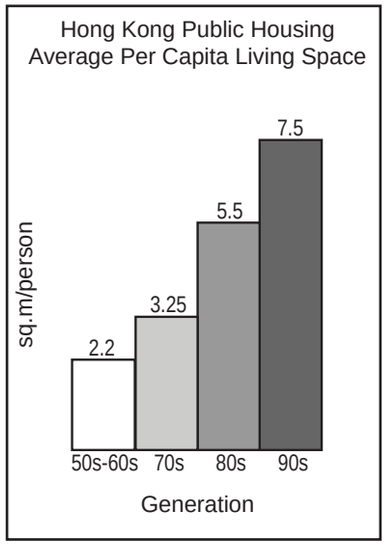
More than 50% of Hong Kong's residents live in public housing, a result of an aggressive effort begun by the government in the 1950s to help alleviate a severe shortage of affordable housing. The Hong Kong Housing Authority (HKHA) built a finite number of housing prototypes at a given time, reducing design and construction costs. As spatial and construction standards increased over the years, new prototypes were introduced.

Though numerous prototypes were built, they can be grouped into four distinct generations: 1950s – 1960s, 1970s, 1980s, and 1990s. Each of these generations is illustrated in this section, including data for the average living space per person and typical building floor plans.

While these particular building types are not necessarily appropriate for wholesale application within a development such as Wonderland, they do serve as informative historic precedents of achieving affordability in high density residential environments.

Per Capita Living Space

Despite the increase in residential unit size over the last several decades (corresponding to the introduction of new housing prototypes), units in Hong Kong are still quite small when compared to other countries. Units in the 1990s averaged approximately 7.5 square meters per person, but just thirty years earlier, families were provided with only 2.2 square meters per person. The high densities in Hong Kong have always been a consequence of a shortage of buildable land in the city.

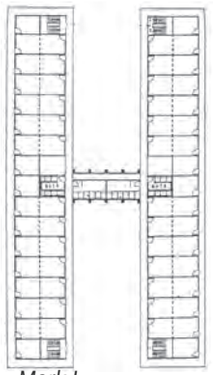


1950s – 1960s

Living space: 2.2 sq. m/person

Prototype: Mark Series

The initial 8-story Mark I buildings consisted of one room units of approximately twelve square meters. Shared kitchens and toilets were located at the center of the building. Later buildings in the Mark series were taller and used a double loaded interior corridor; toilets and kitchens were included in the units.



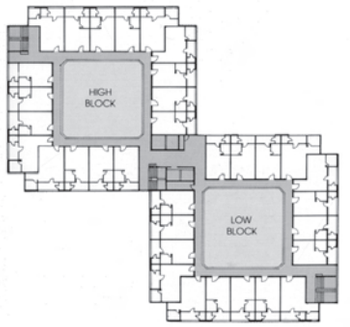
Mark I

1970s

Living space: 3.25 sq. m/person

Prototypes: Slab, Twin Tower, H-Block

Building heights were increased to approximately 20-24 stories and units were enlarged slightly. Some buildings were designed to increase cross ventilation. Bathrooms and kitchens were similar to the later models of the Mark series.



Twin Tower

1980s

Living space: 5.5 sq. m/person

Prototypes: Trident, Flexiblock

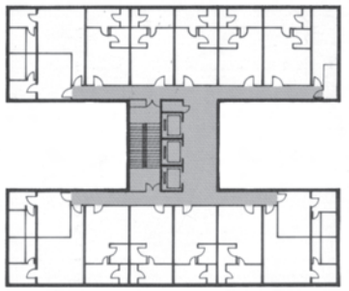
This generation of housing prototypes reflects a significant increase in spatial standards. Building heights were increased to approximately 40 stories and shells were designed to provide a higher quality layout for residents with better light and ventilation. Trident was the most common building prototype.

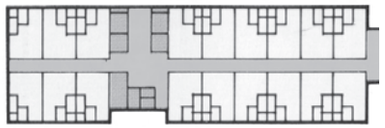
1990s

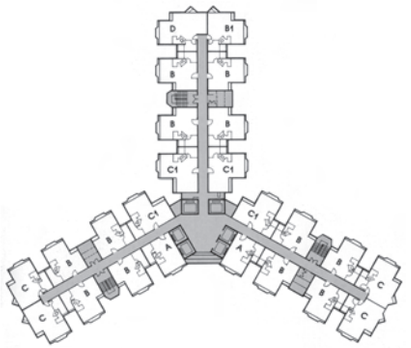
Living space: 7.5 sq. m/person

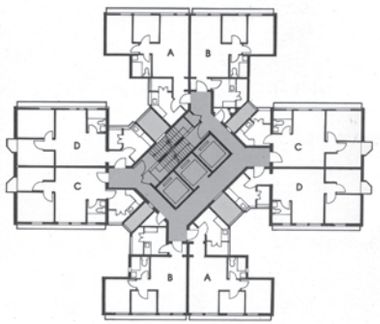
Prototype: Harmony

The overall design approach of the Harmony prototype is similar but more spacious than the Trident series of the previous generation. It was designed using a modular approach, allowing units to be combined to create different building footprints and facilitate a shortened construction period.


H-Block


Slab


Trident


Harmony

Sullivan, Brian Yamaguchi and Chen Ke. Open Building in Hong Kong's Public Housing. Department of Architecture, Chinese University of Hong Kong. October 1995. (Text and Mark I image)

Ng, John, Stephen Tong, Edwin Yim, and W.V. Coffey, eds. Portfolio of Works: Hong Kong Housing Authority – Construction Branch & Housing Department. 1986. (All other images)

CASE STUDY: SUCCESSFUL DENSITY

Greenwich Millenium Village, London

Overview

Situated in East London and expected to be completed in 2013, Greenwich Millennium Village is a mixed use, mixed income development consisting of almost 3,000 units with 30% affordability. It provides a good example of how to achieve clustered, high density development with ample open space and mixed uses. In addition to being a mixed income housing development, it also incorporates features of sustainability.

Location

This development is located on a large brownfield site along the Thames River in London and is surrounded by retail as well as another mixed use development in the process of construction. The area is poised to become a major entertainment and recreational area with a large events hall and a planned metro stop.

Image Source: http://www.union-gmv.co.uk/gmv

Design

* The development has utilized several ways of encouraging diversity:

- Building depths and heights are varied

- Uses are highly mixed

- The affordable housing component forms 30% of the units

* Density averages 185.25 units per hectare

* Use of interior courtyards and balconies, terraces, and covered galleries create a hierarchy of public and private spaces.

* The bulk of the retail and office space is centered on a centralized, landscaped square. This square connects to an ecological corridor of foot and bike paths

* Total site area is 63.8 hectares

Financing

Because it is a Brownfield redevelopment that includes affordable housing, the government heavily subsidized project funding. Environmental Protection provided a generous match because of the innovative nature of the project. As a result of the match, the developer was required to provide a certain number of socially beneficial services. The developer also worked with contractors to decrease the waste associated with construction.

Development Cost Breakout

* Construction: £1,795.25 per square meter

* Average sales price for a unit: £3,762 - £4,730 per square meter

* Land cost: £741,000 per hectare

* Soft costs and general development costs: £ 92,714,764

* Marketing and selling: £35,264,126

Lessons from Greenwich Millennium Village

Variation in architecture is important for good design, but features which do not add measurable value can be standardized. It is useful in new types of developments that utilize new ideologies, such as affordability or sustainability, to engage workers through information campaigns so that they understand the goals of the project and can help work towards those ends.

MIXING COMMUNITIES

Planning for Mixed Demographics

Overview

Demographically, Shenzhen is a product of its rapid economic growth. Currently, the population is comprised mostly of young adults who have migrated from other parts of China in search of prosperity. 73 percent of the workforce is under 35 years old, and income disparity within this group is very pronounced. Highly educated professionals are earning wages that are 26 times those of the low-skilled laborers.

Observations

Interviews conducted at the Wonderland and Metropolitan projects revealed that the family unit is changing. Increased wealth has granted more freedom and independence to young adults and to the elderly. Young people are postponing parenthood, and in some cases, buying separate units for their parents. As a result, the multi-generational housing unit is breaking apart. Moreover, the aged population is expected to double between 2005 and 2015.

Objective

Given this picture, planners and designers must make it their goal to provide more socially connected communities. Though housing developers are currently profiting from the booming real estate market and new middle class, they will have to expand their market base in the coming years. It is important to shift modes and to begin creating communities that provide for people of varying incomes, ages, and lifestyles.

Methodology

Walking distances suggest residential site design strategies for accommodating three significant demographic groups: the elderly, families, and young adults with no children. Isolating each demographic group demonstrates how the strategic locatation of amenities on the Wonderland site serves each group's specific needs. Finally, two concept plans explore the scenario where all three of these demographic groups reside together on the site.

Evaluation Criteria

Each concept plan is evaluated according to three criteria: accessibility, community, and efficiency. Accessibility measures ease of access to facilities and services; community addresses the degree of community cohesion fostered by residential mixing; and efficiency deals with the degree to which facilities and services are shared by residents living in different areas of the site.

Elderly Access to Facilities and Social Networks

Overview

The proportion of people 60 and older is growing faster in China than in any other major country, with the number of retirees set to double between 2005 and 2015, when it is expected to reach 200 million. By mid-century, according to United Nations projections, roughly 430 million people – about a third of the population – will be retirees.[1]

The exponential growth of China's elderly is the result of both improvements in longevity (reflecting gains in nutrition and health care) and a decline in fertility due especially to national policies to reduce the birth rate. Because of the rapid increase in the size and proportion of the population over 60, planning and providing access to facilities, services, and social networks for older people, especially in new, large-scale residential developments, is becoming a major issue in China.

In addition to the growth of the elderly population, a second observable phenomenon greatly impacts future planning for the elderly. Older people in China are leading increasingly independent lives. The proportion of multigenerational households is declining, and this trend is likely to continue as China's middle class expands, raising concerns about the availability of familial support for those in need. Thus, a fundamental question for designers and developers of residential environments emerges: how will changes in family living arrangements affect the delivery of support to the elderly?

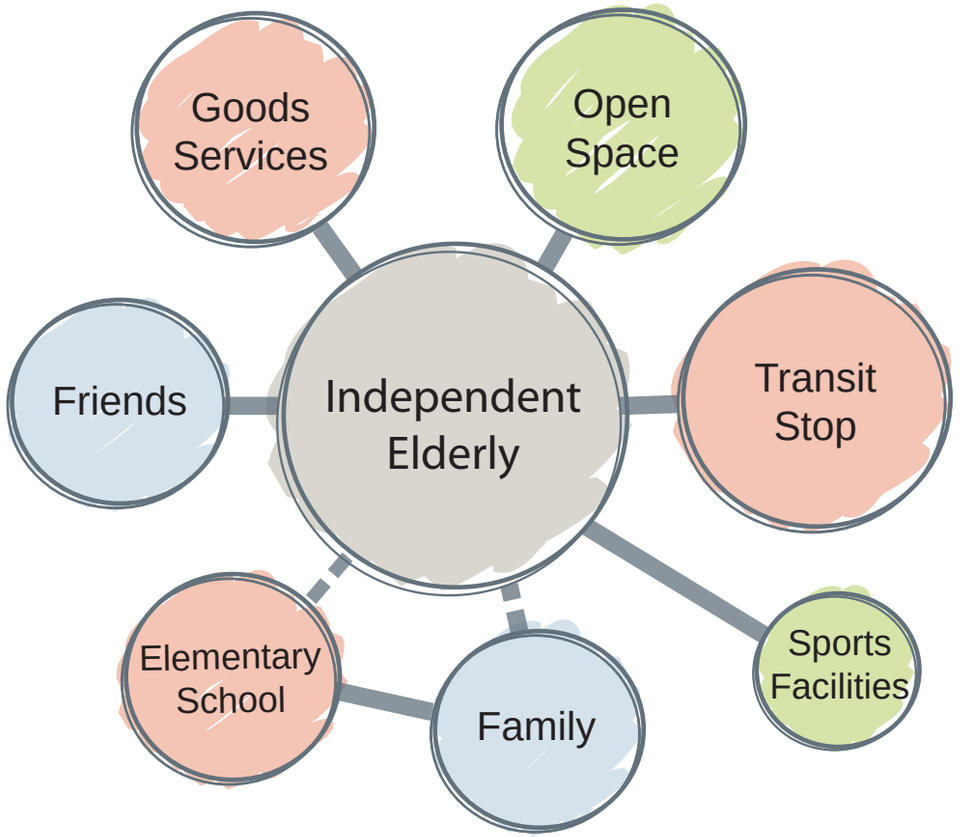
If the elderly are living more independent lives and children are no longer the primary providers of support in the daily lives of elderly parents, then the elderly population must be able to access this support more independently in their neighborhoods. In what ways can and should the design of a community such as Wonderland respond to the needs of its elderly residents?

1. New York Times, 22 March 2007

The Elderly: Access to Facilities and Social Networks

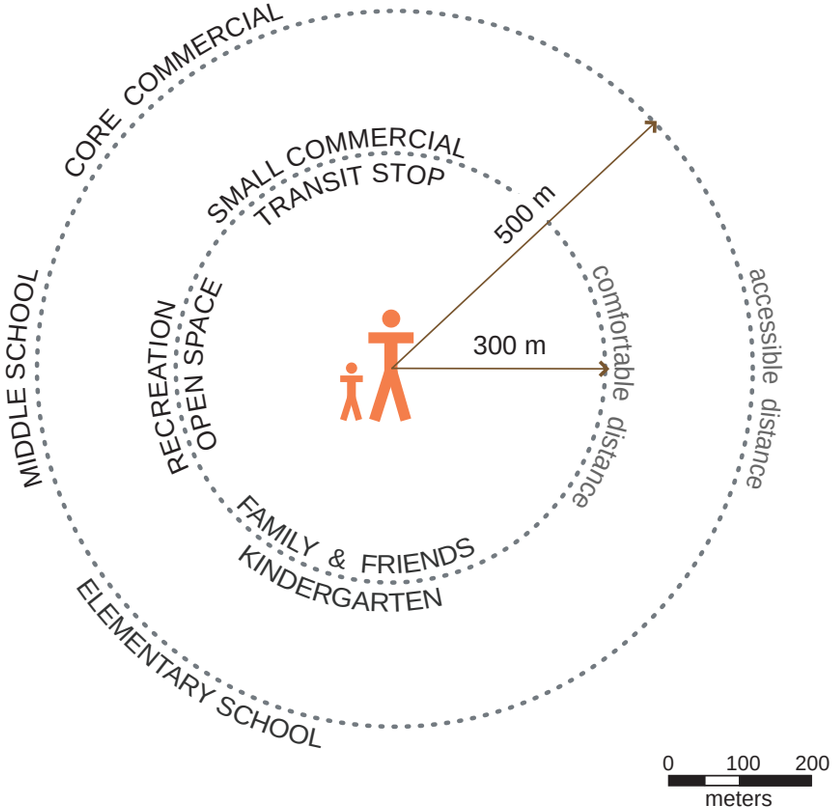
Community Connections

Although an independent elderly lifestyle is based on a desire to control one's own daily life, this independence is predicated on a fundamental network of neighborhood connections. In traditional Chinese villages, social ties to neighbors developed over decades. In new developments comprised largely of individuals who grew up elsewhere in the country, this organically grown network is largely absent, but attentive planning can help foster such social networks. An active, fulfilling, and healthy life of the independent elderly hinges on proximity to an array of facilities, services, and relationships, as depicted in this diagram. This network may include access to food, shopping, a community center (clubhouse), or a bench under a favorite shade tree.



Walking Distances

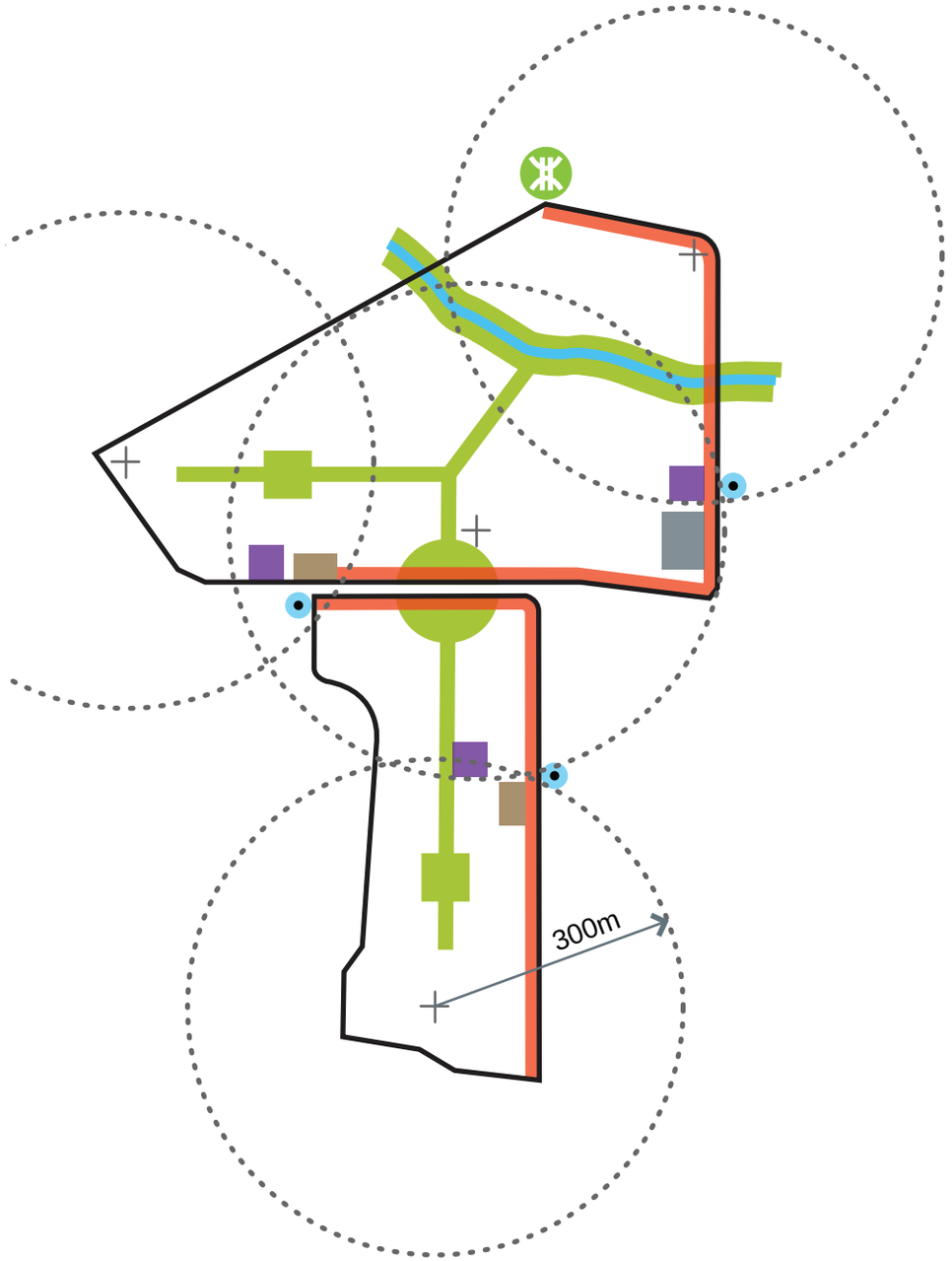
Though within any elderly population there is a range of physical capabilities – from completely mobile to immobile – this analysis considers that, in general, an elderly individual will be less mobile than his younger counterpart. Due to these mobility constraints, a comfortable elderly walking distance is defined as 300 meters (as opposed to 500 meters for a typical younger individual). In order to foster a healthy and independent elderly population, facilities, services, and social networks – such as retail, open space, medical care, transit, and family and friends – should be located within 300 meters of all elderly dwelling units. Such site planning requires deliberate coordination of elderly housing with the daily routines and needs of an elderly population. Other facilities which the elderly may utilize, but with less frequency, may be located up to a 500 meter walking distance. These would be accessible by shuttle bus, or potentially on foot by the most mobile elderly individuals.



Dispersed Model

In the dispersed model, the elderly are located in residential units throughout the site. That is, elderly housing is fully integrated into "regular" apartment buildings inhabited by all age groups, including families with children, married couples without children, and young, single urban professionals. This dispersion may take several forms, each with its own attributes and drawbacks. For example, elderly units could be incorporated in the ground-floor level of buildings, stacked vertically within a structure, or randomly interspersed.

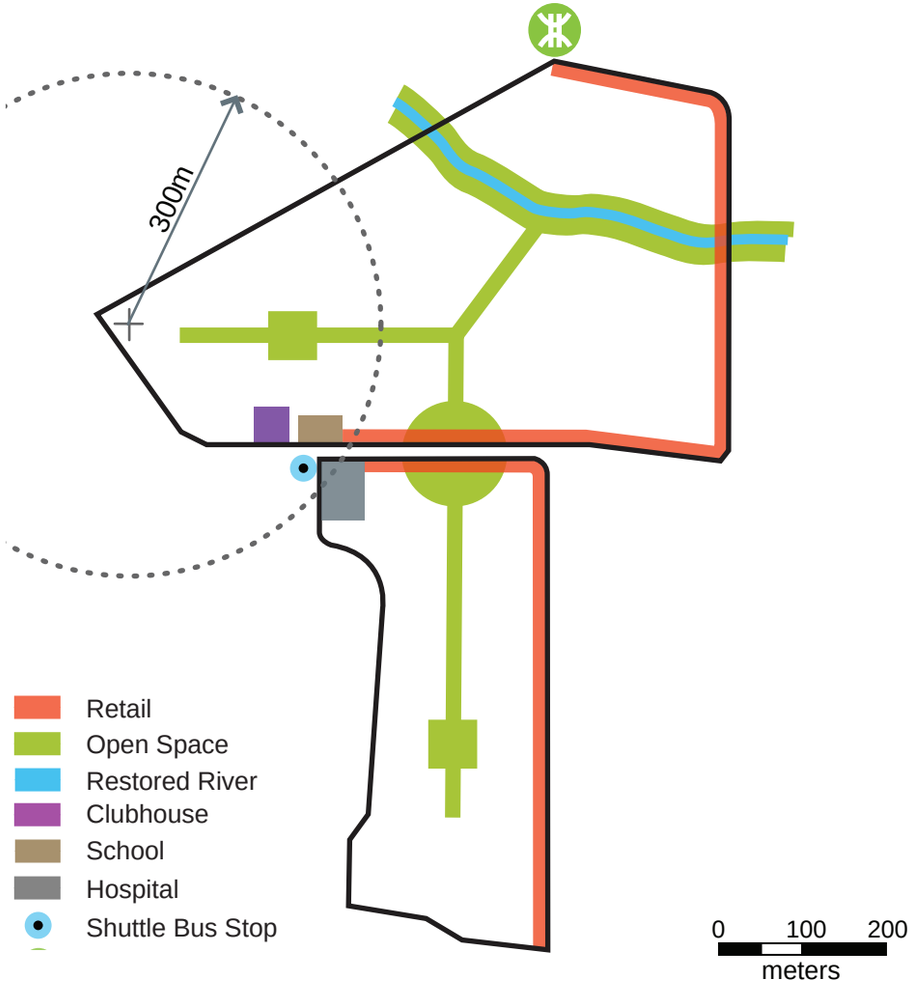
When we apply the 300 meter walking distance to the site as a spatial framework and commit to the location of facilities and services within this walking distance to all elderly residents, three key activity intersections emerge in the dispersed model. Each of these intersections serves as the focus of activity for a "sub-neighborhood" within the larger community. In each of the three sub-neighborhoods, there is a community center (clubhouse) and shuttle bus stop which facilitates access to parts of the site that are located outside of the comfortable walking distance. Two of these sub-neighborhood centers contain elementary schools, and the third includes a hospital, intentionally sited along a main arterial for shared community use. Furthermore, the open space network stretches into each sub-neighborhood with a park, plaza, or greenway.



Concentrated Model

In the concentrated model, elderly residents are clustered in one particular part of the site. This diagram shows that the clustering of the elderly population similarly allows the grouping of facilities and services, such as a community center, elementary school, hospital, and shuttle bus stop; these are all within comfortable walking distance and need not be duplicated elsewhere on site.

Because the elderly are grouped together in this model, their network of peers is quite strong. While elderly are not located at the site's busiest location (near the proposed transit station), they remain immediately proximate to activity, an ideal situation for elderly who enjoy observing, if not joining, the routines of the community. It is important to note that the elderly thrive in environments in which they are close to the hustle and bustle of daily life. Thus, though it seems logical to locate the elderly in a remote, quiet area of a development site, clustering the elderly in such an area actually would be detrimentally isolating, draining much stimulation from an older person's daily routine. However, while the concentrated model guarantees a strong network of peers, it also potentially separates the elderly from the residential areas of other age groups, possibly including children, grandchildren, or younger friends. Diligent planning at the edges of the elderly concentration would be essential to create strong connections to the rest of the development.



Families with Children: Access to Facilities and Social Networks

Overview

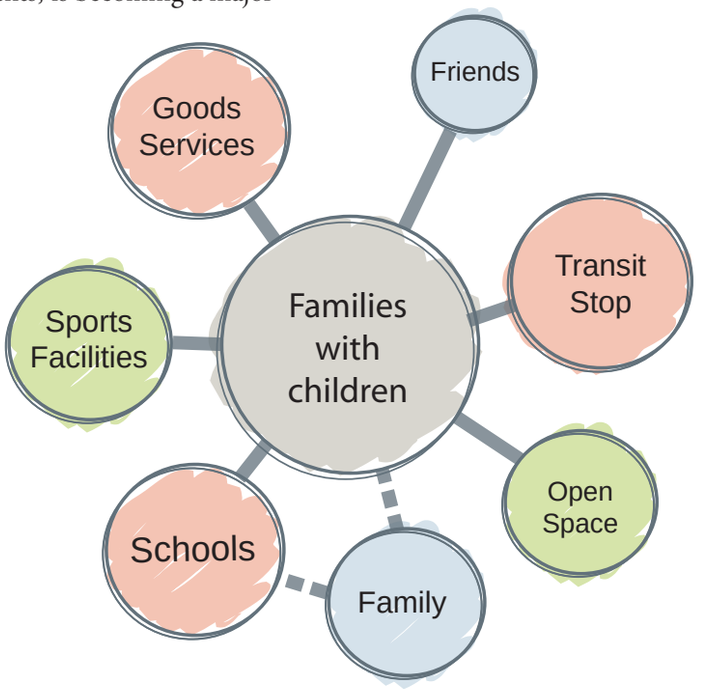
Growth of the middle class is especially prevalent in China's rapidly developing cities, such as Shenzhen, which have been attracting both domestic and overseas investment. In such cities, the prevailing middle class mantra might be characterized as "the harder you work, the more money you earn, and the more successful you will be." Ambitions fall very much in line with the stereotypical aspirations of the middle class elsewhere in the world: namely, a focus on making more money, buying a larger dwelling space, and enrolling children in the best school possible.

The living patterns of families with children are not only impacted by the booming economy and middle class expansion, but also by the transformation of traditional family living arrangements. Intergenerational co-residence historically has been viewed as a realization of China's cultural ideal of "five generations under one roof."[1] Since the late 1980s, family division and independent living of the generations has been occurring earlier and earlier. In the past, couples (including those with children) lived with the husband's parents. Increasingly, however, the trend is for young families to buy their own apartments and move out, or for the elder generation to choose to live independently.

This redistribution of the family is altering the structure of familial support, gradually eroding the traditional pattern of grandparents watching over young grandchildren during the day as parents are busy at work in the city. Thus, a fundamental question for designers and developers of residential environments emerges: how will changes in family living arrangements affect the facilities and services needed by families with children?

Community Connections

Because of the increasingly frenetic lifestyles of middle class families with children, providing access to facilities, services, and social networks, especially in new, large-scale residential developments, is becoming a major issue in China. Indeed, planning for fundamental changes to the activities of daily life – including where, what, and when a family eats, how family members choose to spend limited recreation time, and in what ways people access services and neighborhood

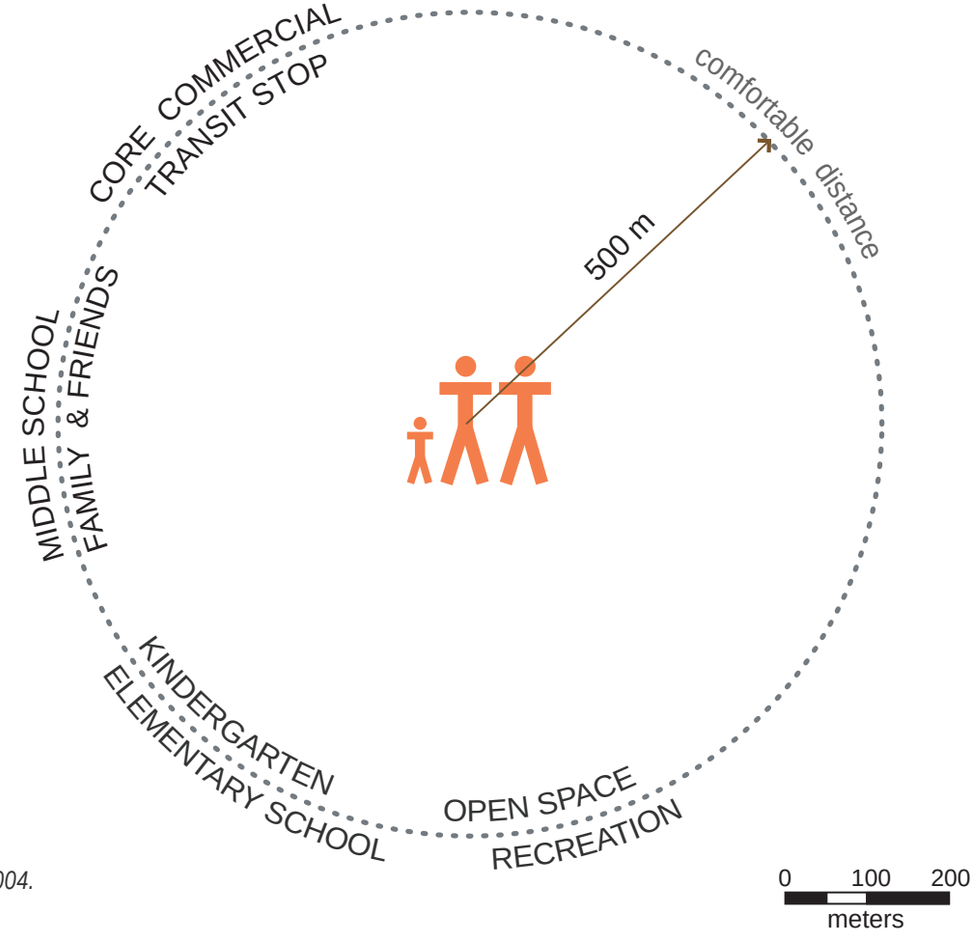


facilities – is a primary challenge for residential designers and developers.

There are several important community connections. Families with children will in particular value access to and interconnections among their residential unit, schools, and extended family (such as parents). Since families with children have limited free time away from work and family-related responsibilities, it is also important that shopping areas, sports and recreation facilities, and friends are proximate to the home. Similarly, families that juggle busy schedules would highly value quick and convenient access to transit.

Walking Distances

Comfortable walking distance, defined as 500 meters for a typically mobile family with children, should apply to a range of facilities, including schools (kindergarten, elementary, and middle schools), open space, core commercial (for quick, convenient, on-the-go shopping), and transit, a primary mode of transportation to work in the central business district or elsewhere in the city. Given work and family demands, including care for children and assisting with care of elderly parents in times of need, it is important that physical and social networks be readily accessible and convenient. Social networks likely will revolve around residential adjacencies (neighborhood), recreational activities (sports, clubs, etc.), and professional connections.

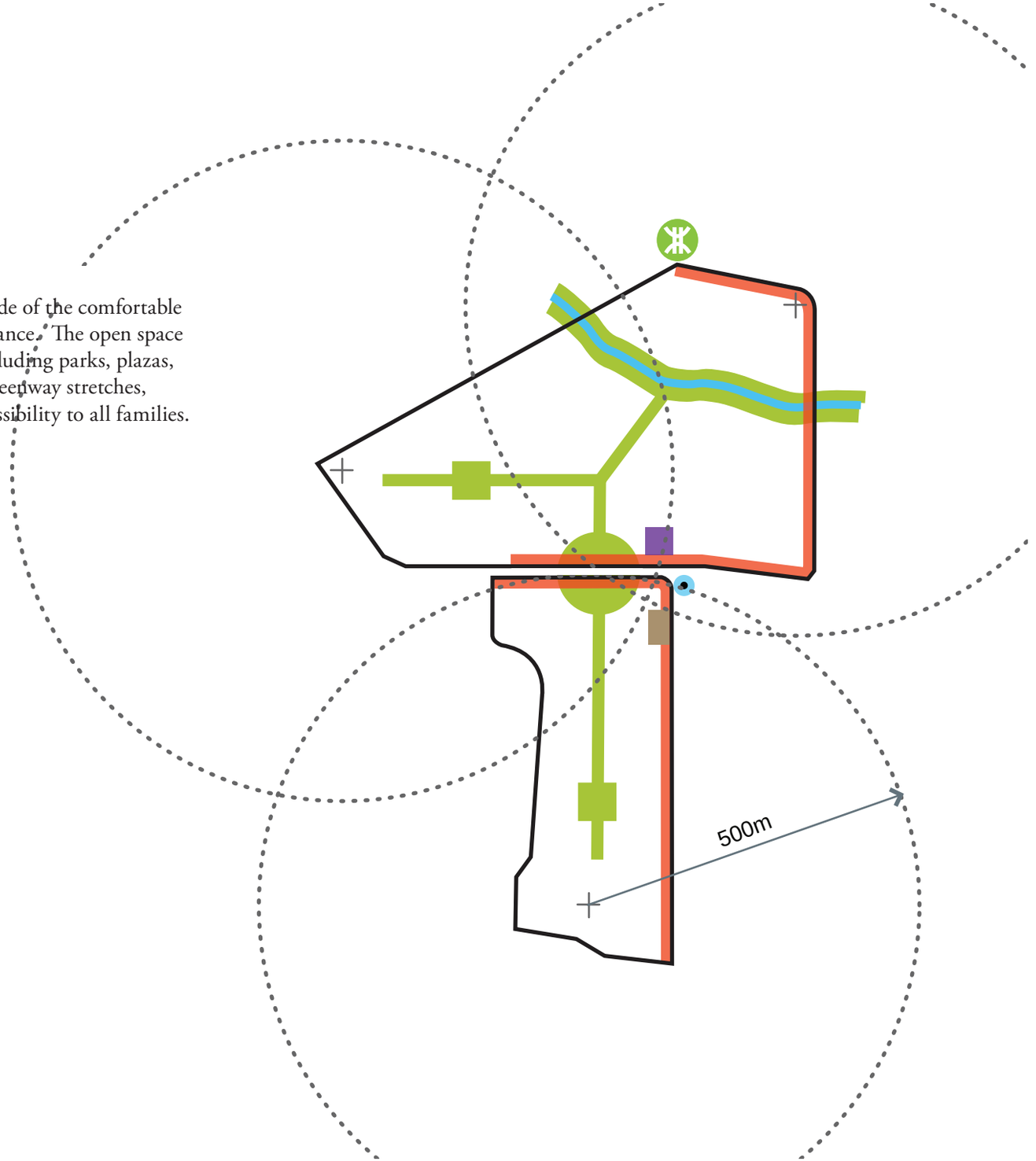


1. Charlotte Ikes. "The Impact of Housing Policy on China's Urban Elderly". The Institute, Inc. 2004.

Dispersed Model

In the dispersed model, families with children are located in residential units throughout the site. Housing for families is fully integrated into buildings inhabited by all age groups, including the elderly and young, single urban professionals.

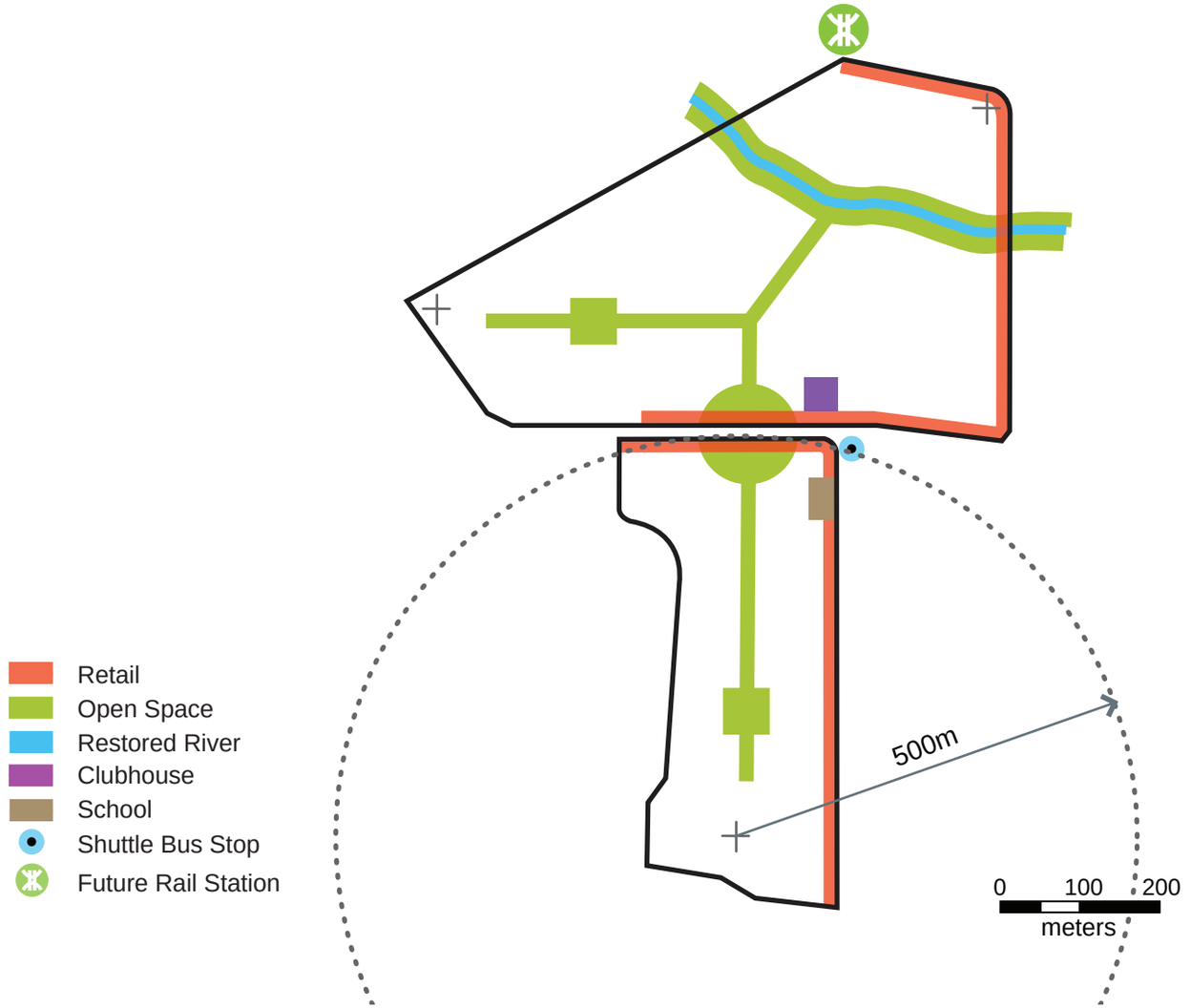
When we apply the 500-meter walking distance to the site as a spatial framework, and commit to the location of facilities and services within this walking distance to all families, one key intersection of activities emerges in the dispersed model. This intersection, located approximately where the two halves of the development meet, serves as a facilities and services center for the entire site. It contains a community center (clubhouse), school, and shuttle bus stop which facilitates access to parts of the site that are located outside of the comfortable walking distance. The open space network, including parks, plazas, and linear greenway stretches, extends accessibility to all families.



Concentrated Model

In the concentrated model families are clustered in one particular part of the site. This diagram shows that clustering utilizes the same organization of facilities and services as the dispersed model. Thus, concentrating families achieves no additional efficiency in terms of facility sharing.

Because families are grouped together in this model, the neighborhood social network of parents and children is quite strong. However, concentrating families with children in the southern portion of the site creates undue separation from the proposed transit station, complicating work-day commutes. This model also creates a distinct separation between families and the elderly living elsewhere on site, a separation which would be inconvenient for anyone caring for an elderly parent.



Young Adults without Children: Emerging Lifestyles

Overview

Shenzhen, China's first Special Economic Zone, magnetically attracts two kinds of migrants – highly educated, upwardly-mobile professionals and migrant laborers with little education. Together, these two groups form the hard-working backbone of the growth economy, skewing the average age in Shenzhen to just under thirty.

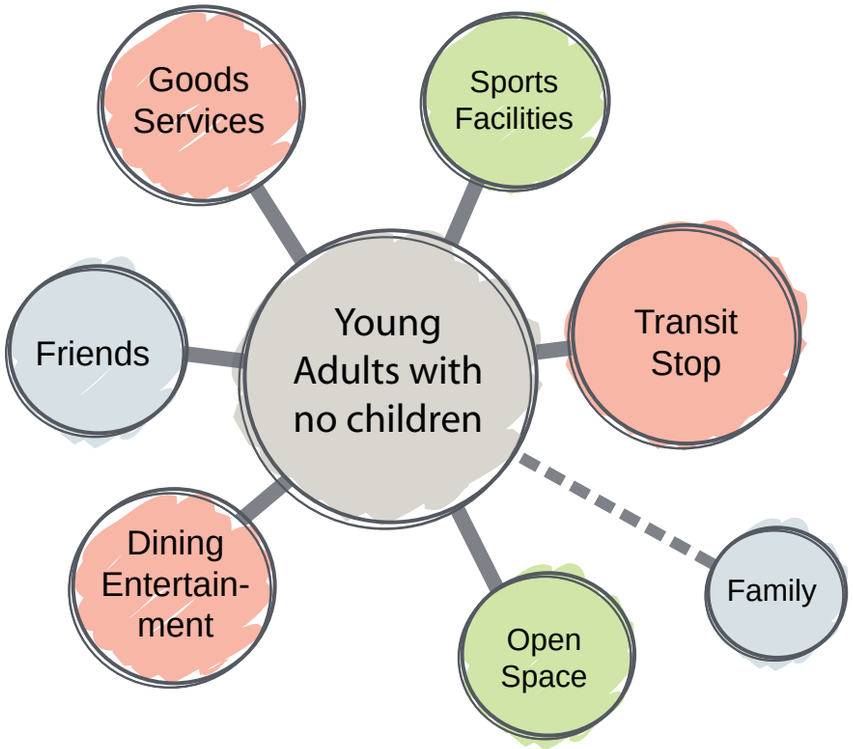
With national family planning policies in effect, 10 to 12 hour workdays, and a lack of immediate family support, young adults in Shenzhen are likely to put off parenthood. Living independently or with a spouse, a new class of urbanites has emerged. White collar workers with their disposable incomes form the consumer base, while blue collar workers form the production and service base.

When designing housing for either or both parties, lifestyle must be considered. The needs of this population are quite different than that of the previous generations.

Community Connections

Young, independent adults migrating from elsewhere in the country have little time outside of the working hours for a domestic lifestyle. Convenient and direct access to transportation is essential for cutting commuting times. With limited time and some amount of disposable income, these young adults consider dining, shopping and entertainment the central activities in their lives.

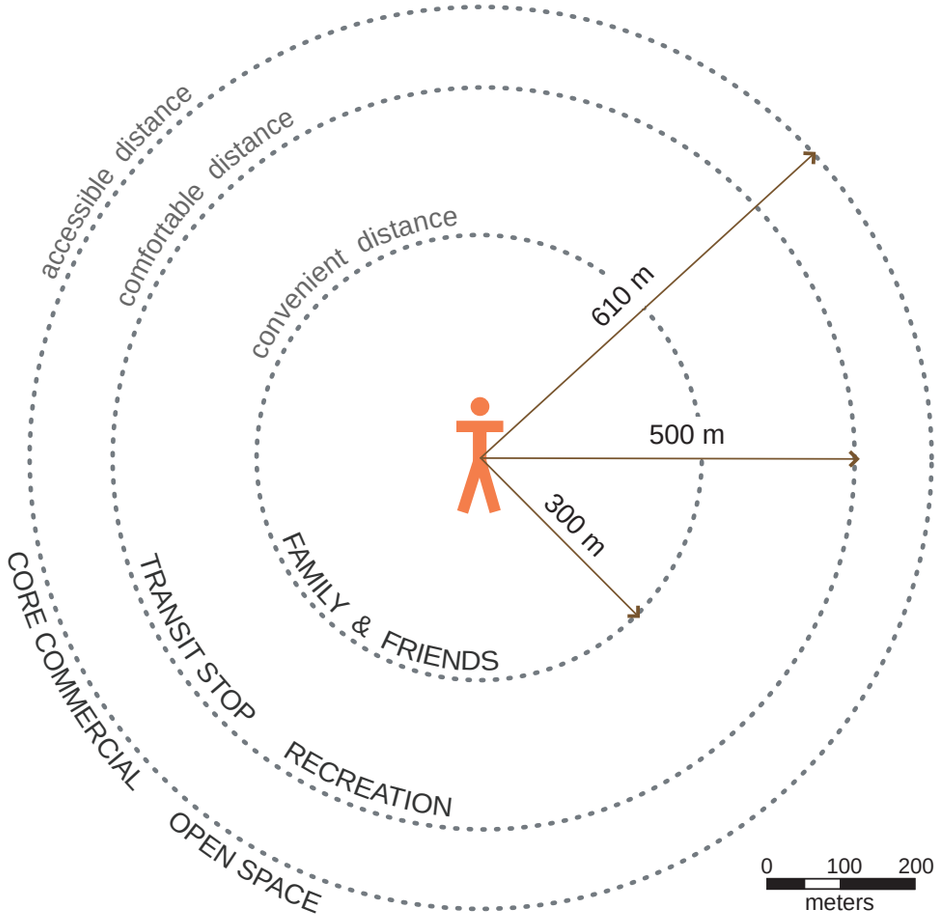
Such a lifestyle can be isolating, potentially leading to emotional distress if appropriate social connections are not made. Friend networks must replace traditional family networks. Venues that support



peer relationships must be easily accessible for this demographic group.

Walking Distances

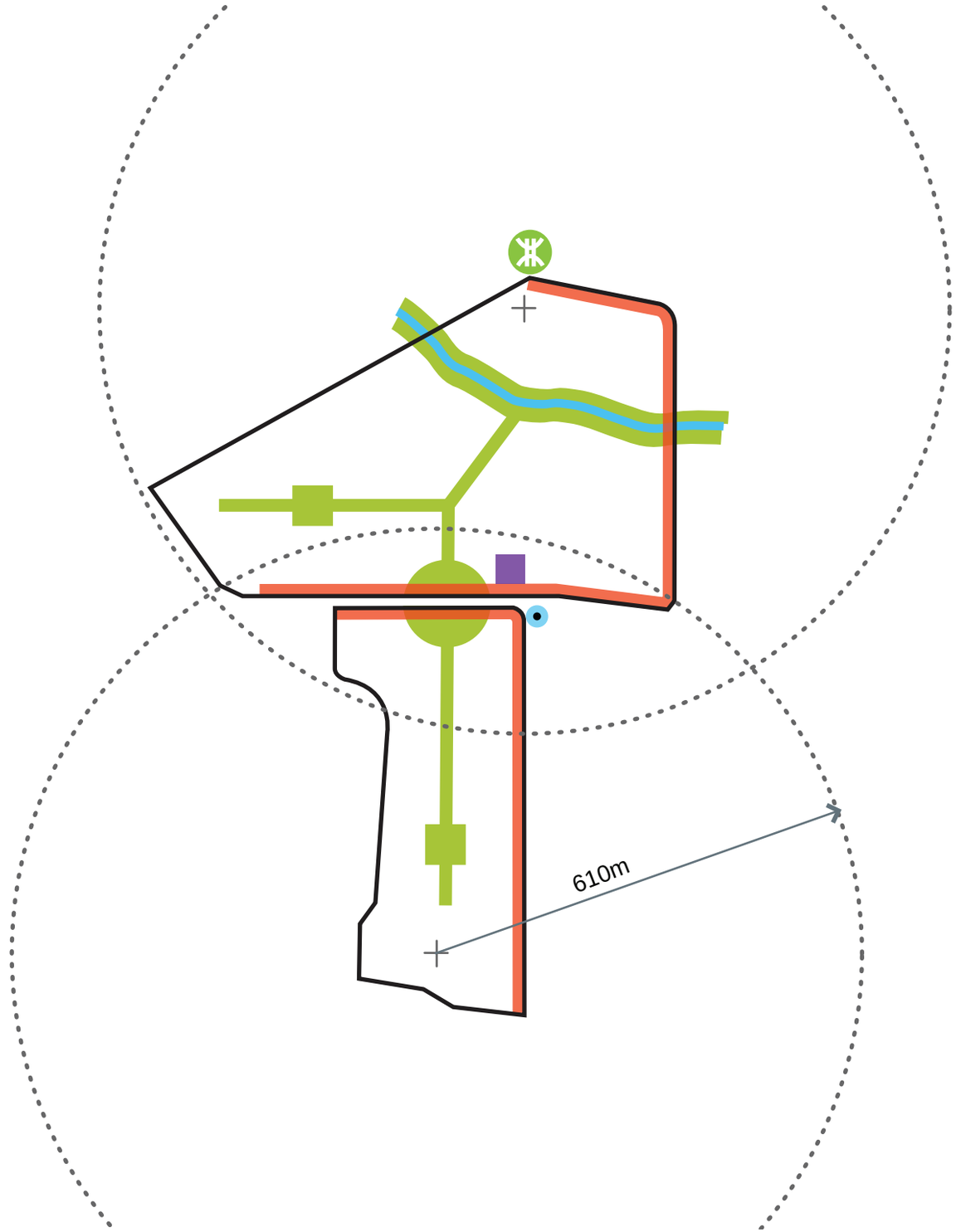
Surveys suggest that a comfortable walking distance for most people in ordinary daily situations is 400 to 500 meters (10 minutes). As the most mobile members of a community, young adults with no children can tolerate slightly further walking distances to destinations not regularly visited.



Dispersed Model

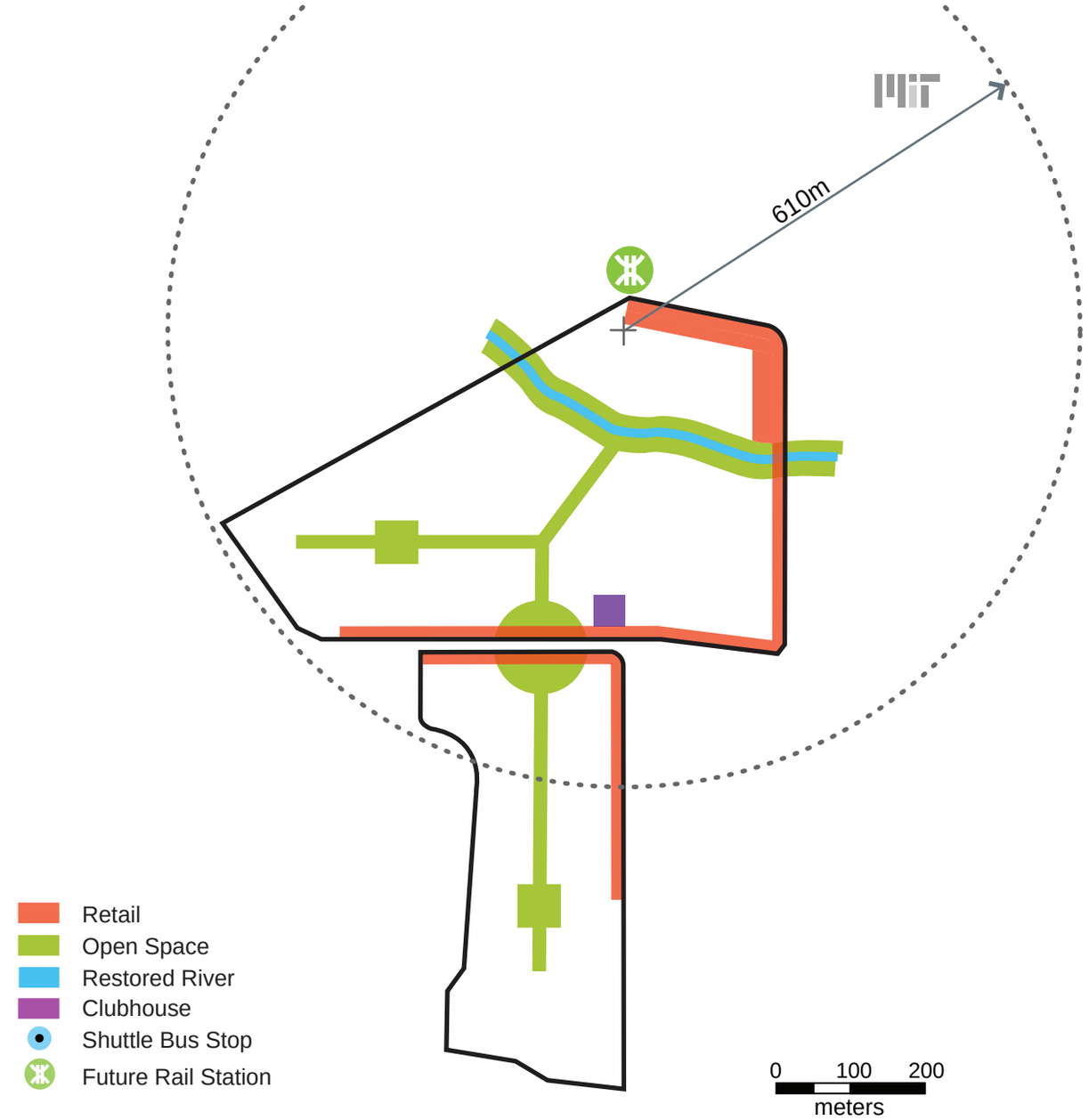
In the dispersed model, all buildings on a site are inhabited by all demographic groups, including the elderly, families with children, and young adults without children.

For young adults without children, a 610 meter walking distance can be applied to the site as a spatial framework. Committing to the location of facilities and services within this distance, two "sub-neighborhoods" form, each with their own green space and transport stop. These "sub-neighborhoods" intersect at the bisecting road between the north and south parcels of the site. Key activity nodes emerge along this "Main Street." The community center (clubhouse) and shuttle stop locate there along with retail and commercial functions.



Concentrated Model

In the concentrated model, young adults without children are clustered in only one part of the site. Considering the daily routines of such residents, it is logical to cluster this population around the proposed rail station and its associated retail development.



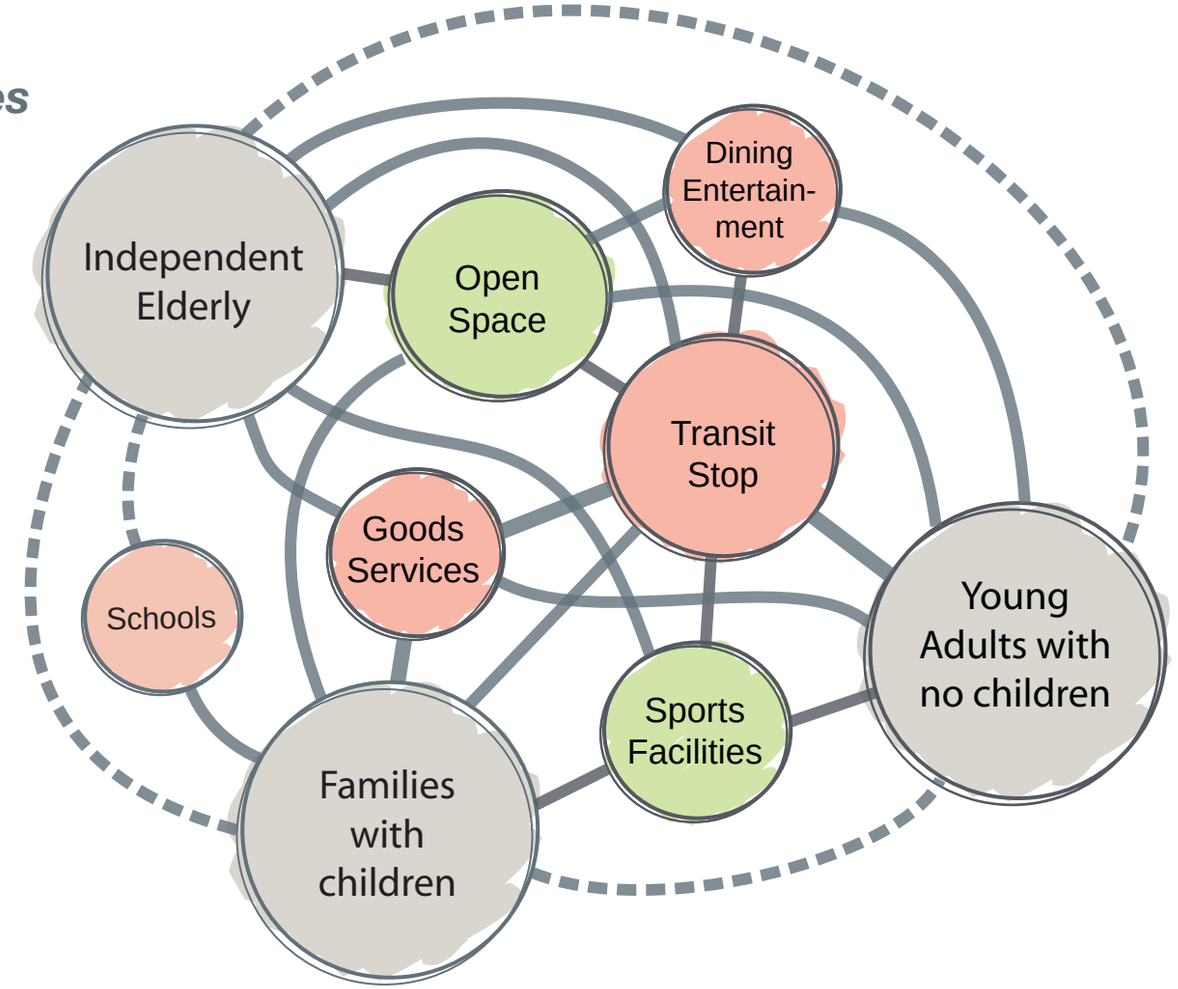
Combining Ages and Lifestyles

Overview

To create a highly diverse neighborhood, all ages and lifestyles must be accommodated within a site. Amenities must be located strategically to serve everyone.

Previously we explored isolated demographic groups to explore six site design models for Wonderland:

* Elderly – Dispersed
* Elderly – Clustered
* Families – Dispersed
* Families – Clustered
* Young Adults without Children – Dispersed
* Young Adults without Children – Clustered



Methodology

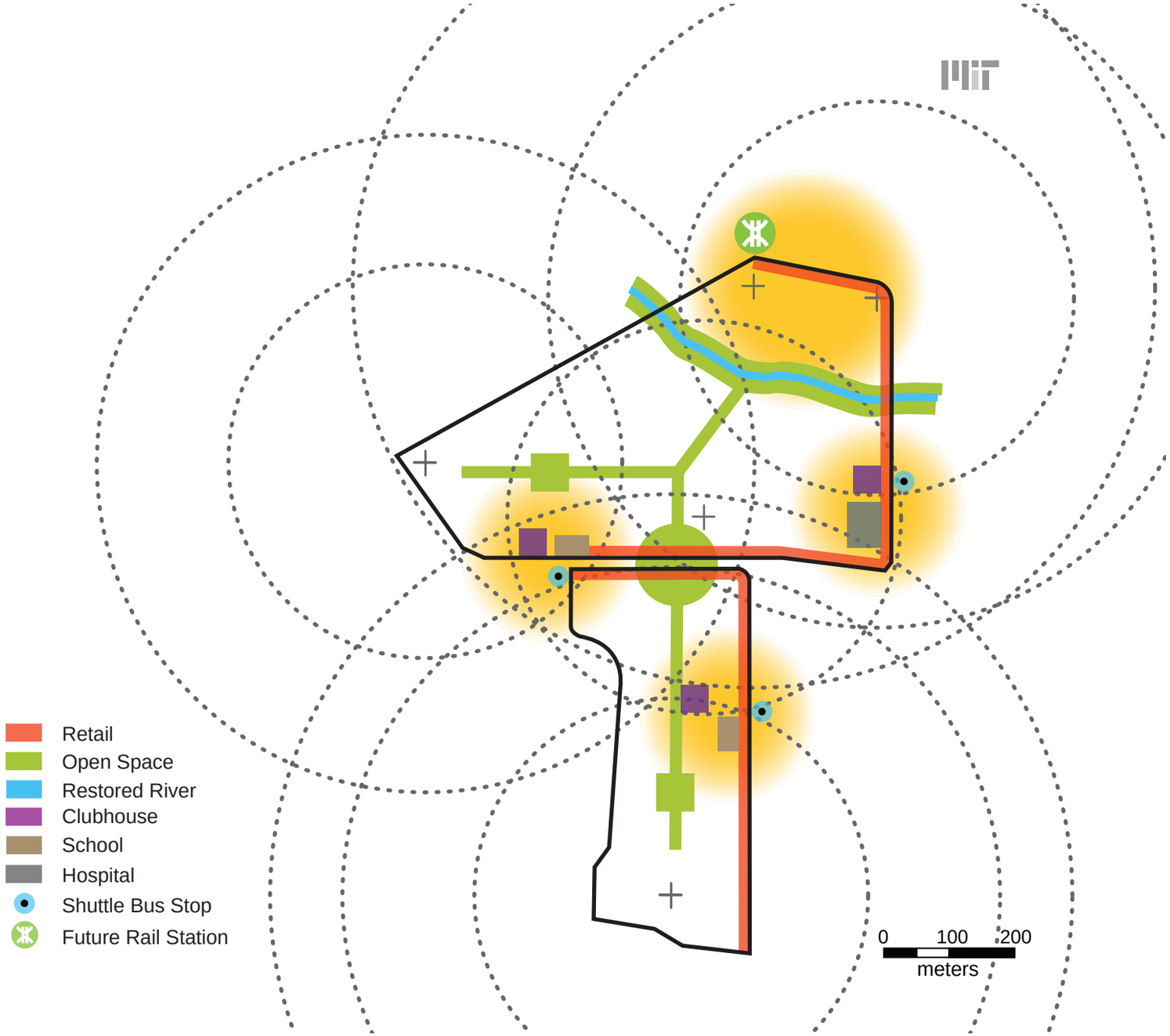
Consolidating these six models, we can generate design strategies for a site that would house all three demographic groups – the Elderly, Families, and Young Adults without Children.

Again we apply two methods for spatially distributing the residents:

* Combined Dispersed Model: housing for the three demographic groups is spread out over the entire site
* Combined Clustered Model: the three demographic groups are housed in separate zones on the site

Dispersed Model

In the dispersed model, all buildings on a site are inhabited by all demographic groups, including the elderly, families with children, and young adults without children.

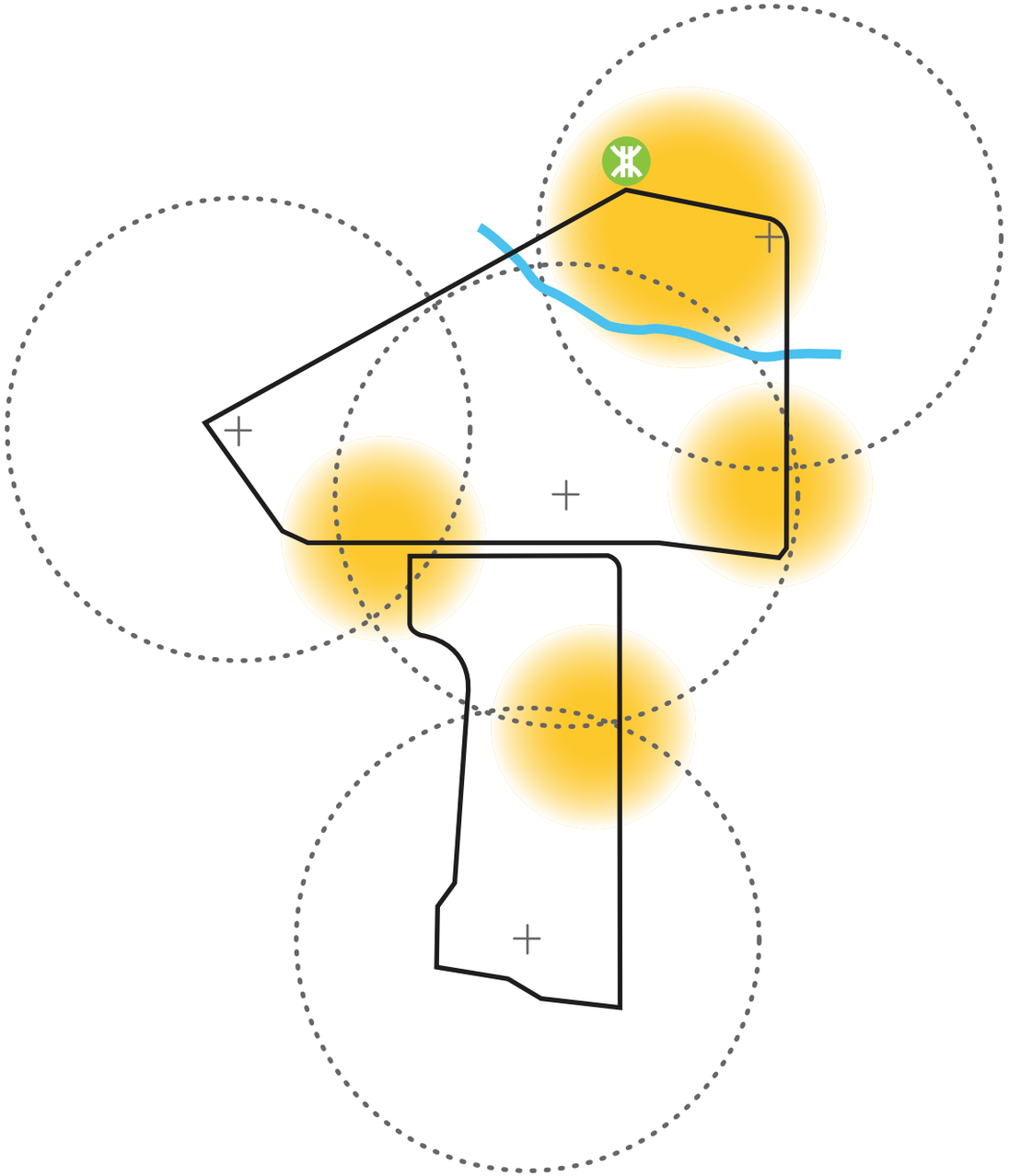


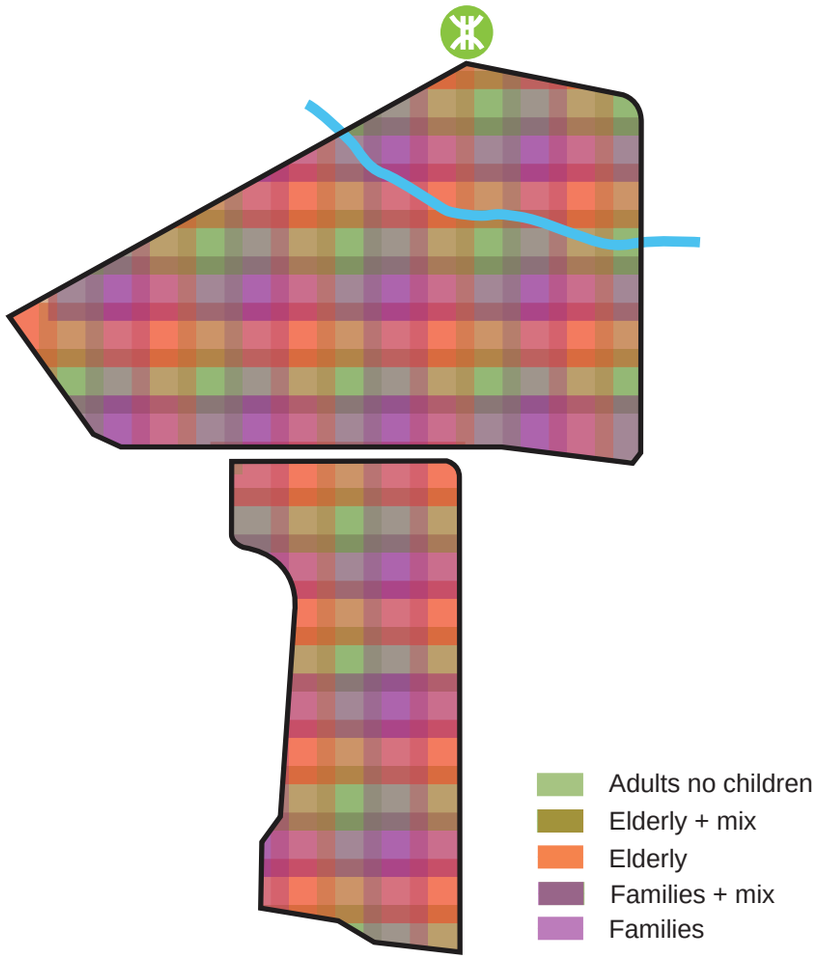
Walking Distances

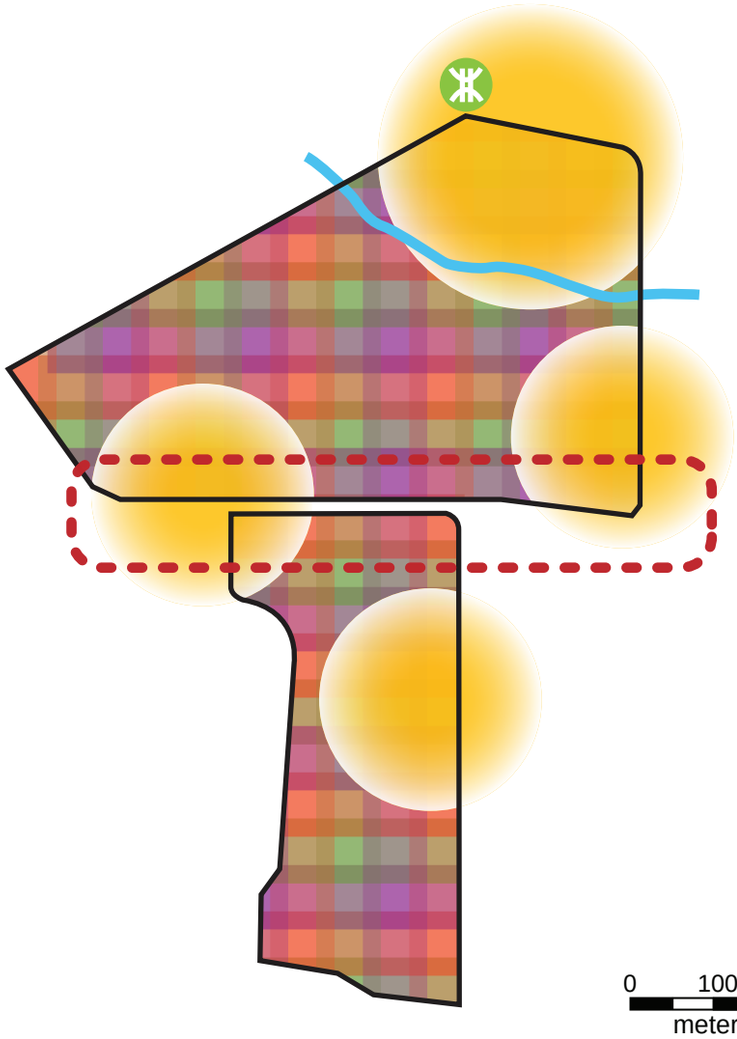
Applying walking distance radii to the site can help determine the locations of amenities. Since the elderly are the least mobile, the 300 meter radius of travel is the limiting factor for site design.

The result is that four walkable sub-neighborhoods form. Public amenities are clustered along the roads in the three places where these "sub-neighborhoods" intersect.

Other public and commercial spaces cluster around the proposed rail stop and at the bisecting road between the north and south parcels. This road becomes a "Main Street" that connects the three sub-neighborhoods furthest from the rail transit node.





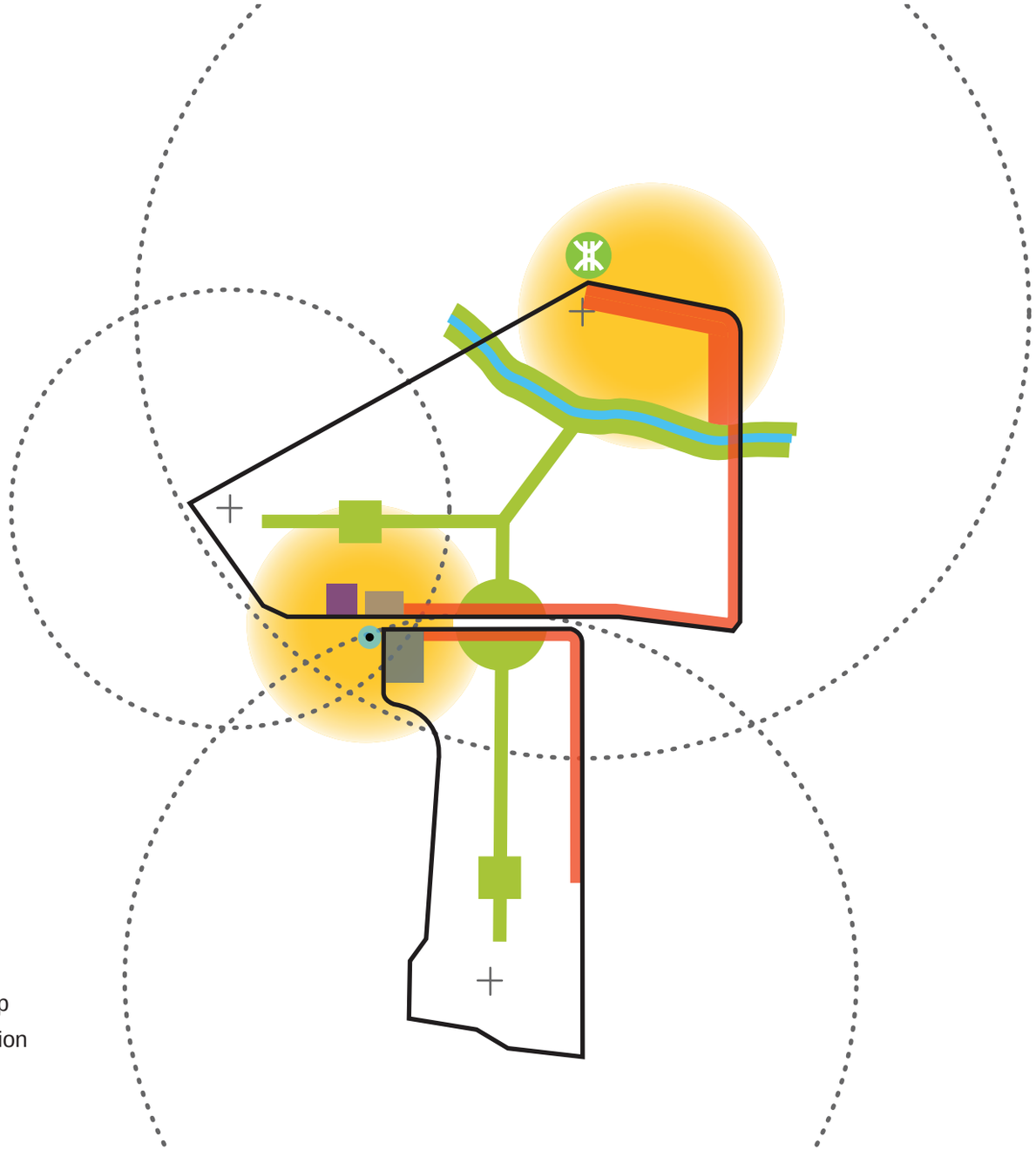


Adults no children
Elderly + mix
Elderly
Families + mix
Families

0 100 200
meters

Concentrated Model

In the concentrated model, each of the three resident demographic groups – elderly, families with children, and young adults without children – is clustered in separate parts of the site.

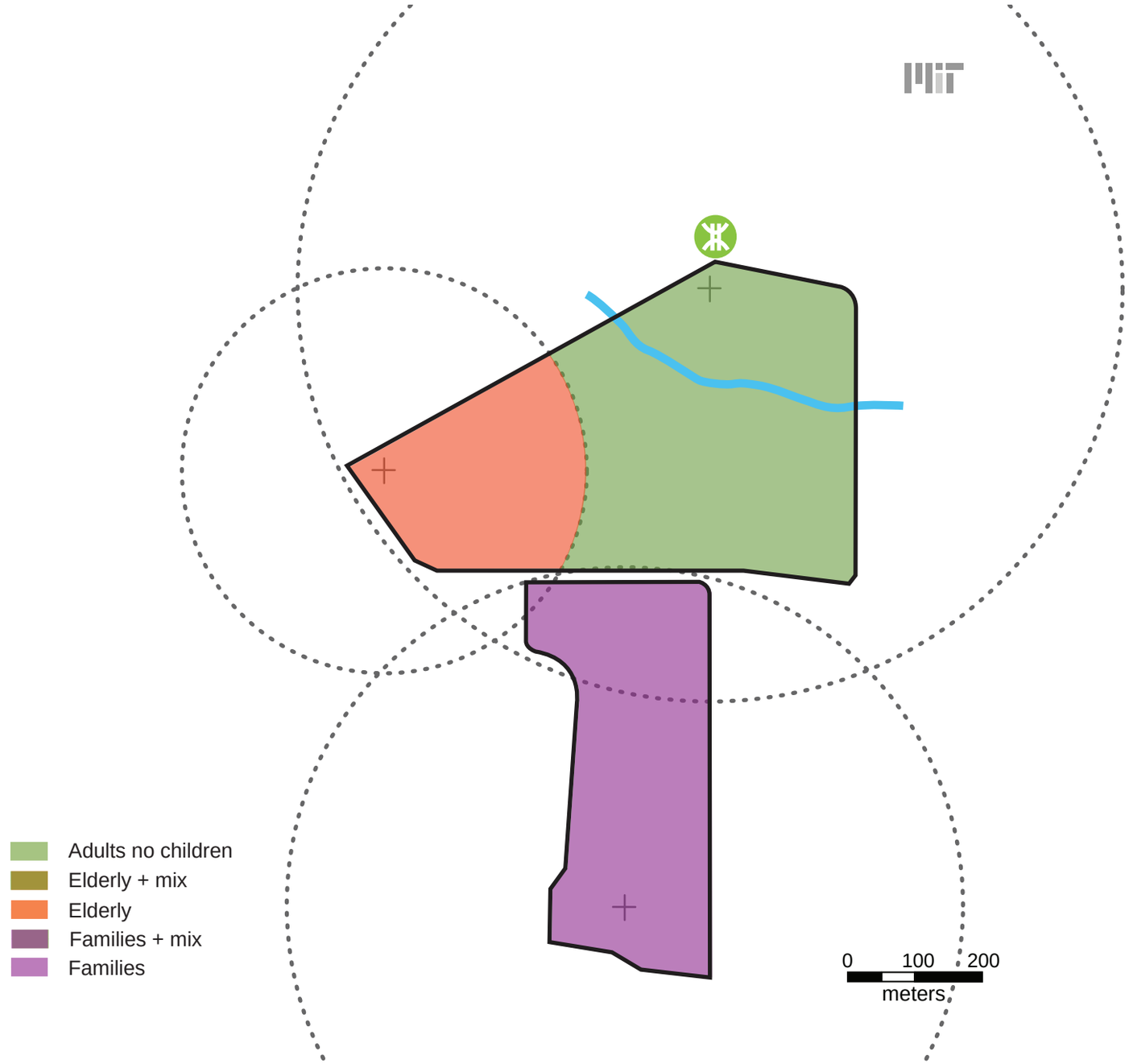


Walking Distances

Considering the lifestyle preferences for each demographic group and applying walking distance radii to the site enable the site to be divided into three sub-neighborhoods.

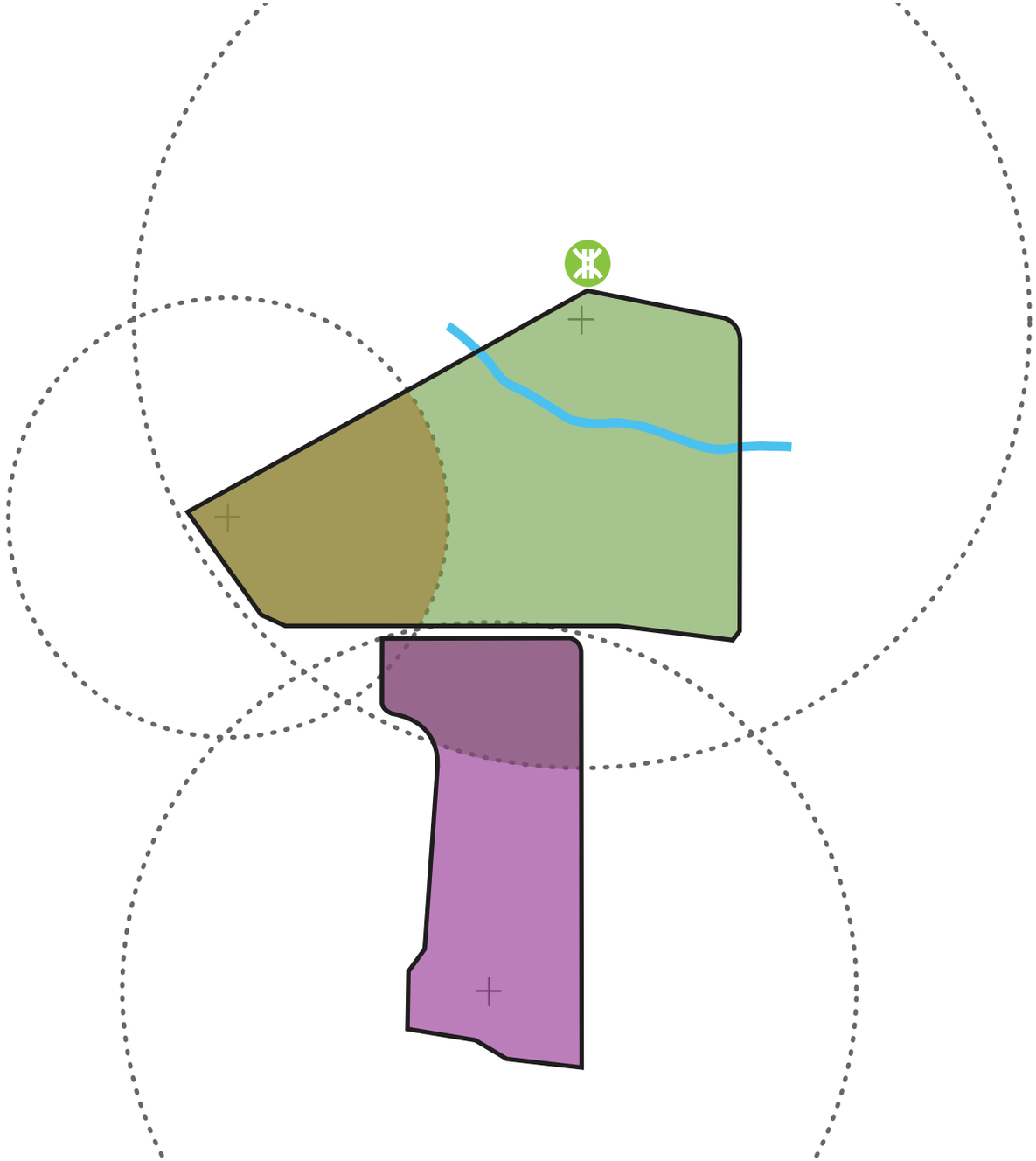
Young adults with no children cluster around the transit node and the busy arterial road at the east edge of the site. The elderly occupy the west part of the site, and families get housed in the south parcel.

Public amenities are consolidated in one location along the bisecting “Main Street” where the walkable edges of the sub-neighborhoods overlap.



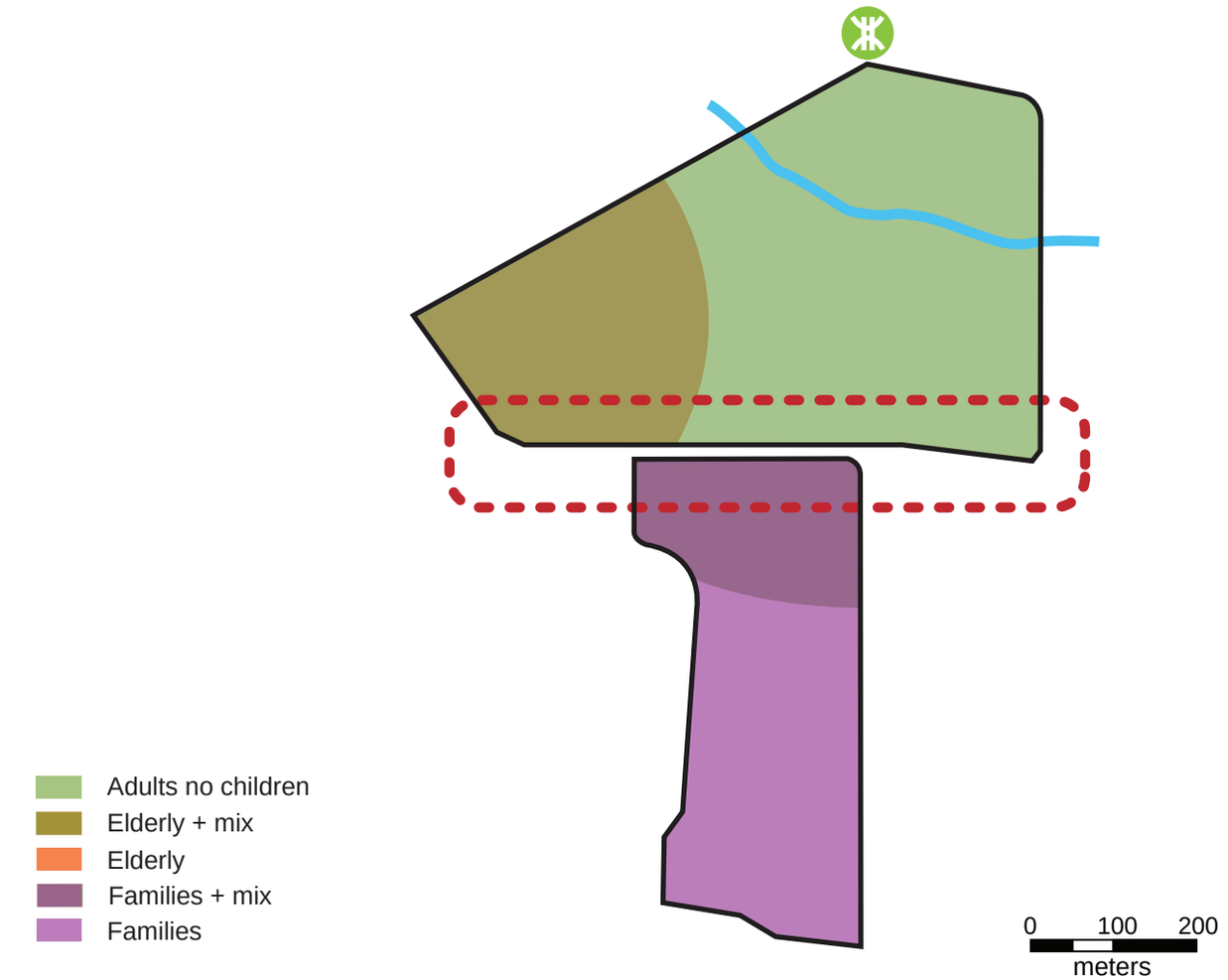
Sub-Neighborhood Overlap

We can imagine that the young adults without children would have the greatest flexibility in terms of location choice, due to their high mobility and less specialized service needs. Although we assume that they will cluster around the transit node, these residents could potentially spill into the elderly or family sub-neighborhoods.



Joining the Site

Assuming there will be demographic spillovers across subneighborhoods, both the western part of the site and the bisecting road become integrated residential zones. The "Main Street" and the associated facilities then become the center for mixing.



CASE STUDY: SUCCESSFUL MIXING OF COMMUNITIES

Rollins Square, Boston

Overview

Located in Boston and completed in 2003, Rollins Square is an award-winning residential complex serving a wide range of income earners. It is a well-designed mixed-income project that seeks to create a truly socially diverse and vibrant community.

Location

Rollins Square is in the South End of Boston at the intersection of two neighborhoods. It abuts 19th century brick houses and a warehouse district. It is close to downtown Boston and within walking distance to the Theatre district, grocery stores, banks, restaurants, and shops. It is served by the Washington Street Silver Line Transitway that connects to the downtown subway system.

Income Mix

Rollins Square employs a very aggressive income-mixing strategy:

* 20% of the units rent to people under 30% AMI
* 40% were sold to moderate-income first time homebuyers
* 40% were market rate units selling for up to $750,000 each

The vibrant community has evolved from this mix. The residents include very low-income families, service workers, nurses, teachers, and dual-income couples.

Source: CBT Architects

Financing

Funding for the $67 million came from fourteen sources:

* $8 million in subsidies
* $4 million in Low-Income Housing Tax Credits
* City, state, private, and foundation funds
* Land donation for affordable units
* $11 million in foregone fees contributed from developer

Source: buillderonline.com

Source: buillderonline.com

Design

Rollins Square features 184 units on a 2.19-acre site. There are four 4-story townhouse buildings and four 8-story buildings apartment buildings organized around a courtyard. Units range from one-bedroom flats to three-bedroom duplexes. There is absolutely no physical differentiation between "affordable" and "market-rate" units. Two retail strips serve the community at the street level. A two-story below grade parking garage provides plenty of space for residents.

FAR: 4.19

Total Site Area: 95,395 square feet

Lessons from Rollins Square

Rollins Square was conceived by the Archdiocese Planning Office for Urban Affairs, whose mission is "to develop high quality housing where people can live with dignity and respect in homes they can afford… as a matter of social justice." The project ambitiously serves a very broad range of incomes while maintaining complete spatial integration throughout the site.

The project has won awards for design, building construction, financing, and social responsibility, and is locally known as the ideal model for Mixed-Income development. Within 2 years, the re-sale value of market-rate units rose to 30-50% above the purchase price.

The high quality design, community governance structure, management practices, and excellent location all allow for the creation of a very diverse community of wealthy and poor.

CONCLUSION

Building Diversity with Affordability

This section provides a set of tools that help create a community where people have different income levels, family sizes, and lifestyle preferences. The financing strategies and mixed-income development strategies are offered as a foundation for exploring the economic feasibility of such projects. The density studies provide an exploration of how these policy changes might affect the urban form. Finally, the mixing communities section represents an understanding of how these physical and financing tools can be leveraged to create community across diverse demographic groups.

For clarity we isolated each tool for designing for diversity. In reality, however, some combination of financing strategies, increased density, unit diversification, and strategic site planning is necessary for successfully designing a mixed-income, mixed-aged community.

Creating affordable housing is an essential element of building diversity because current privatized housing prices exclude seventy percent of China's urban residents from home-ownership. This market demand is complemented by a policy imperative, as recent government initiatives have mandated specific measures to increase affordable housing options. With demand from the market and support from the government, private developers can significantly impact China's affordable housing needs. To do so feasibly, private developers will require a package of different subsidy tools that can be used individually or together.

Income disparity is extremely high in the Special Economic Zones. Currently there is a spatial separation between the poor and the wealthy. Such separation negatively affects the health of a city, reinforcing economic and social stagnation in isolated areas.

The spatial organization of a city has a great effect on the way that people can interact. Segregating the wealthy into isolated communities can siphon off the social capital from the rest of the city. By taking density into account when designing affordable housing, the developer can supply more amenities to those who need it, as well as creating an urban environment which incorporates, rather than stratifies, the residents who live there.

In addition to a changing economy, the family unit is changing due to increased wealth, government family planning policies, and mass migration. Young people are migrating to Shenzhen from other parts of China, leaving behind family networks. They are postponing parenthood to live independent urban lifestyles, and in some cases buying separate dwelling units for their parents.

Moreover, the elderly population is supposed to double between 2005 and 2015, while the next generation will be significantly reduced in size due to the one-child rule.

At this moment in history, the large amount of migration across China creates a sense of detachment and insecurity. For the wealthy, this can be supplemented with gated communities that provide gates as well as a sense of community. In the future, the social networks in these cities will be more stable, decreasing the need for a physical separation to create a sense of security. At that moment, mixed income communities will be a wonderful way to integrate people of all income levels and ages into shared communities which are designed to foster interaction among diverse people.

Relief Map of Shenzhen.
Photo: Shutsu Chai

ENVIRONMENTAL MANAGEMENT AND EDUCATION

This section addresses the importance of restoring natural systems during the site planning process, the role of waste management and recycling in environmental quality, and the influence of education on effective implementation. The Wonderland residential site in Shenzhen, China is used in this section as a reference for how suggested interventions can be successfully planned and managed.

Shutsu Chai
Sophie Martin
Molly Mowery

INTRODUCTION

Sustainability: Looking Beyond the Present

The Pearl River Delta region is in a time of economic boom. Growth has been occurring at an unprecedented pace. This growth brings an increased rate of resource consumption and shifting trends in development. Special care must be taken to protect the natural environment and ensure economic, social, and ecological sustainability for the region's future.

In coming decades, more pressures will be placed on infrastructure, water, energy, land, and environmental quality. More specifically, access to fresh water is becoming limited as residential and industrial development increases, landfill space is running out, and the increase of paved surfaces disrupts the natural flow of waste water. Larger impacts of global warming will also have an effect. Frequency of natural storms will demand better stormwater management systems, a cap on greenhouse gas emissions will limit the amount of untreated landfill waste, and clean renewable energy will step into the forefront as the main provider of electricity needs.

As a result, the costs of basic services are expected to rise, including water, electricity, and trash collection. Alternatives to current patterns of development and urban growth will therefore become more attractive both economically and environmentally.

The implications of this inevitability require government officials, industry leaders, and developers to participate in the formation of policies, incentive programs, and best practices. Additionally, citizens must be educated to ensure that they make conscious lifestyle decisions. This process should be viewed as an opportunity for engaging Shenzhen in a global movement toward environmental responsibility and cooperation.

Thoughtful planning of resources and the natural environment is an important component of successful sustainable residential developments.

Key Components of Environmental Management and Education

Stormwater Management

Low Impact Development (LID) methods of naturally managing stormwater can help prevent flooding, enhance a site's environmental quality, minimize the amount of unfiltered water that is sent to municipal water treatment facilities, and help capture water for reuse on site.

Waste Management and Recycling

Waste management addresses the need to reduce, reuse, and recycle materials. Through composting, innovative building construction and demolition techniques, waste to energy recovery programs, and other mechanisms, waste management can help countries meet long term land use, climate, health, and economic goals.

Community Education

Based on the premise that awareness and knowledge of how to act will influence behavior, this topic explores strategies for teaching community members how to best manage limited resources. These education strategies include: schools, public art programs, signage, community gardens, informational boards and booklets, technology, rebates, and competitions.

Left: Bioretention pond in a parking area. Source: www.urbanwaterquality.org/raingardens/

Center: Recycling bins in Shenzhen development. Source: Shutsu Chai.

Right: Beach Elementary School, Green School Program participant. Source: www.maeoe.org/greenschool/overview.html.

EXISTING CONDITIONS

Natural Systems Prior to Urbanization

Environmental Geography

Shenzhen is part of the Pearl River Delta region of Guangdong Province and lies just north of Hong Kong. Before its designation as a Special Economic Zone (SEZ) in 1980, the city was a collection of small fishing and farming villages.

The area is characterized by low, rolling mountain ranges that generally run from northeast to southwest. Peaks are around 700m, while the hills and valleys range from 200 to 400m. Most streams flow down the mountains from south to north. By 1980, a system of large and small dams was built for flood control and irrigation purposes.

As noted in Wong's *Shenzhen Special Economic Zone*, lateritic red soil covers the bedrock in most of the district. Heavy rainfall has leached this soil of most of its nutrients. Slightly more fertile "paddy" soil covers the valley floors and alluvial flats, although an impermeable clay layer lies beneath.

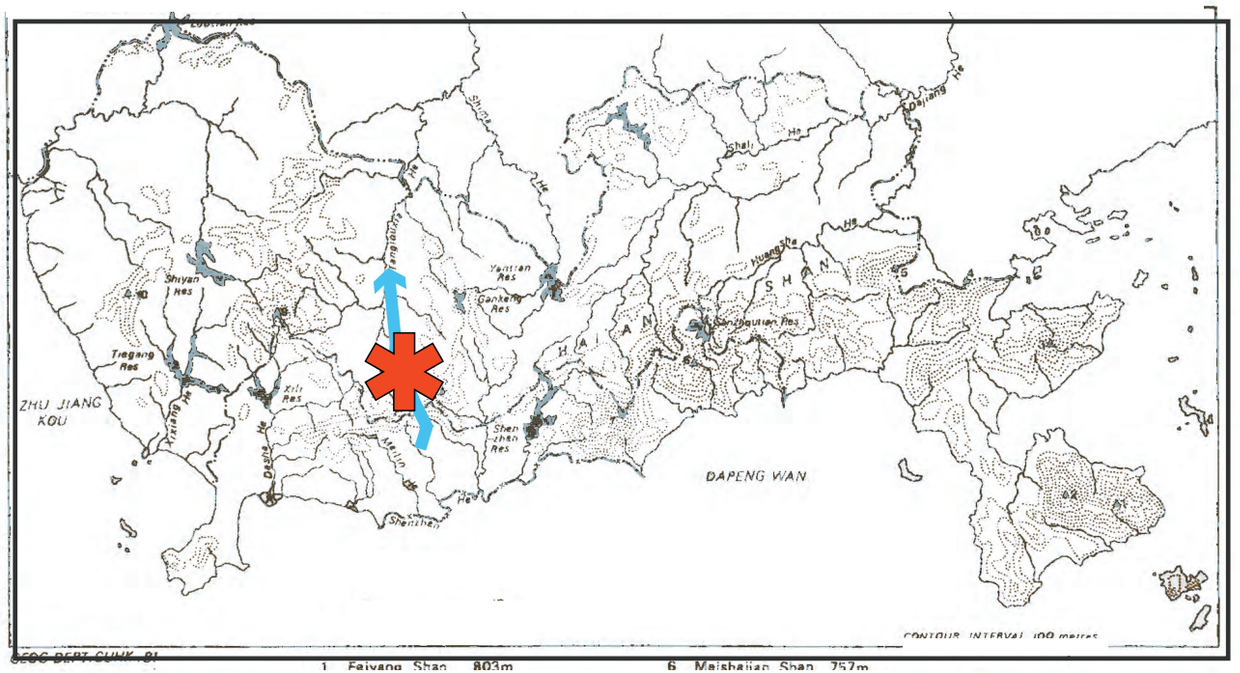
The climate is monsoonal humid, similar to Hong Kong: cool, dry winters and hot, rainy summers. The mean annual temperature is 23°C, with a maximum of 37°C in summer and minimum of -2.5°C in winter.

Average annual rainfall is ~1,900mm, most of which falls in a few days over the summer in monsoons. This pattern is similar to other major cities with monsoon climates, such as Mumbai, which has an average annual rainfall of 2,130mm. By contrast, Beijing's average annual rainfall is just 635mm, typical of its northern, more temperate climate.

The maximum recorded monthly rainfall in Hong Kong in the past 20 years was 1,150mm in July 1994, which probably represents the most major monsoon event that the area could expect to see.

Natural Systems Prior to Urbanization

Relief and Drainage of Shenzhen



Contour Interval: 100m

0 10km N

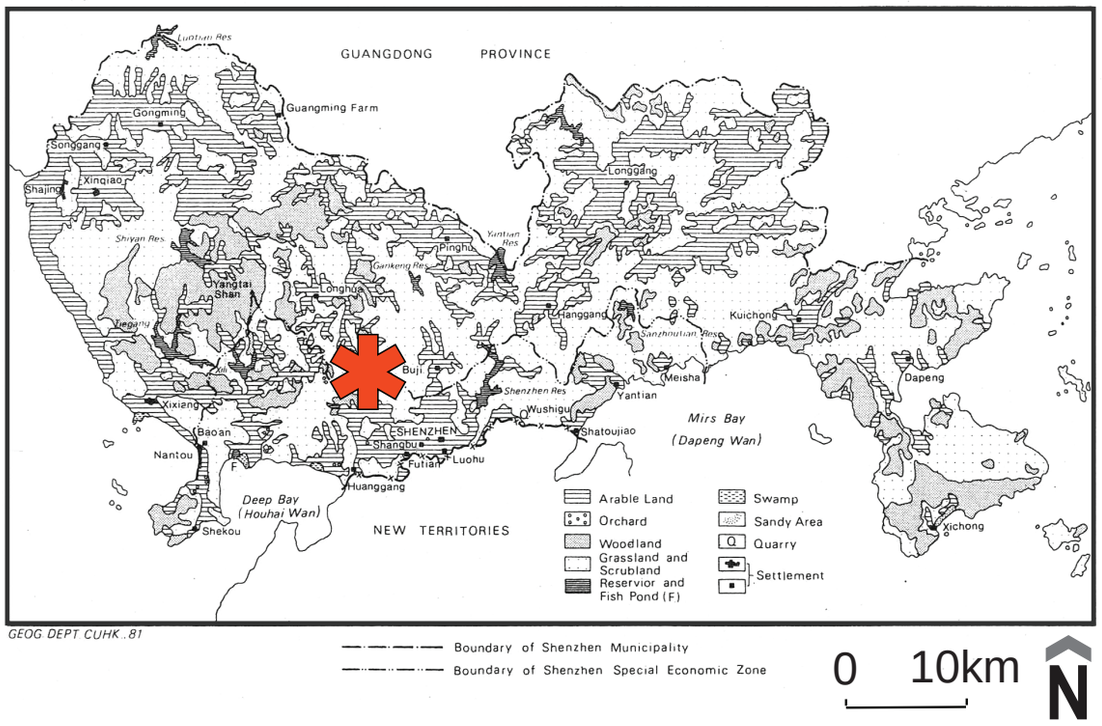
Maps of Shenzhen from 1982 provide clues about the site's original natural conditions, including hydrology, topography, and land type.

The first map of Shenzhen's relief and drainage shows several streams flowing north down the mountains, through and/or near the site.

Source: Kwan Yiu Wong, ed. Shenzhen Special Economic Zone. (Hong Kong: Tai Dao Publishing Co., 1982), p. 14.

Natural Systems Prior to Urbanization

Land Use Map of Shenzhen Municipality



The second map shows pre-urbanization land uses, which correspond closely with the area's environmental geography. Because of its proximity to streambeds, much of the site was arable land. The remaining area, and the site's surroundings, were grassland and scrubland.

Source: Kwan Yiu Wong, ed. Shenzhen Special Economic Zone. (Hong Kong: Tai Dao Publishing Co., 1982), p. 30.

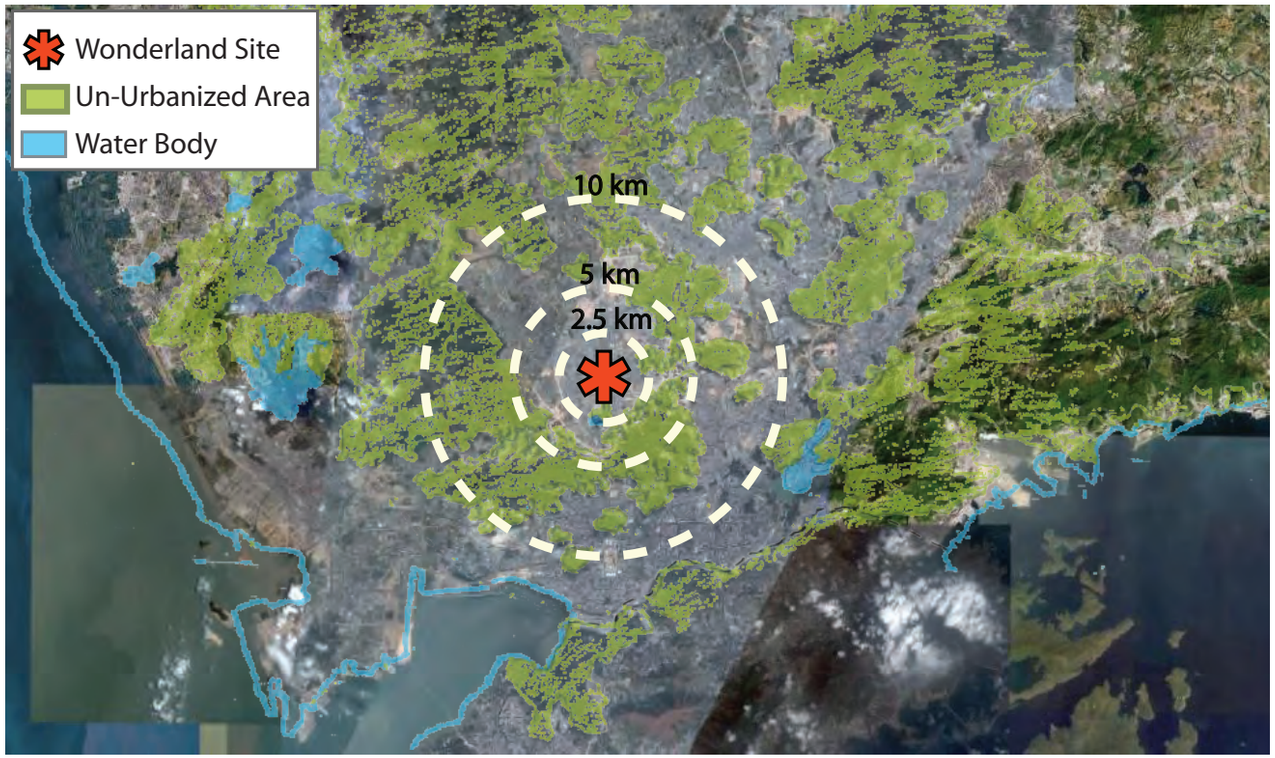
Current Regional Open Space

Open Space Network

Shenzhen's subtropical climate originally supported a broadleaf evergreen forest. However, human settlement and economic development resulted in heavy deforestation. The land has since become scrub and grassland with scattered pine trees. More trees have been planted around reservoirs.

The region still maintains a strong open space network, but the Wonderland site is located in an area where many of those connections have been broken. While the site borders undeveloped mountains to the south, this open space network is not carried through to the north.

The challenge is finding ways to reintroduce open space and reconnect the natural systems in and around the site.



Regional Open Space and Major Water Bodies

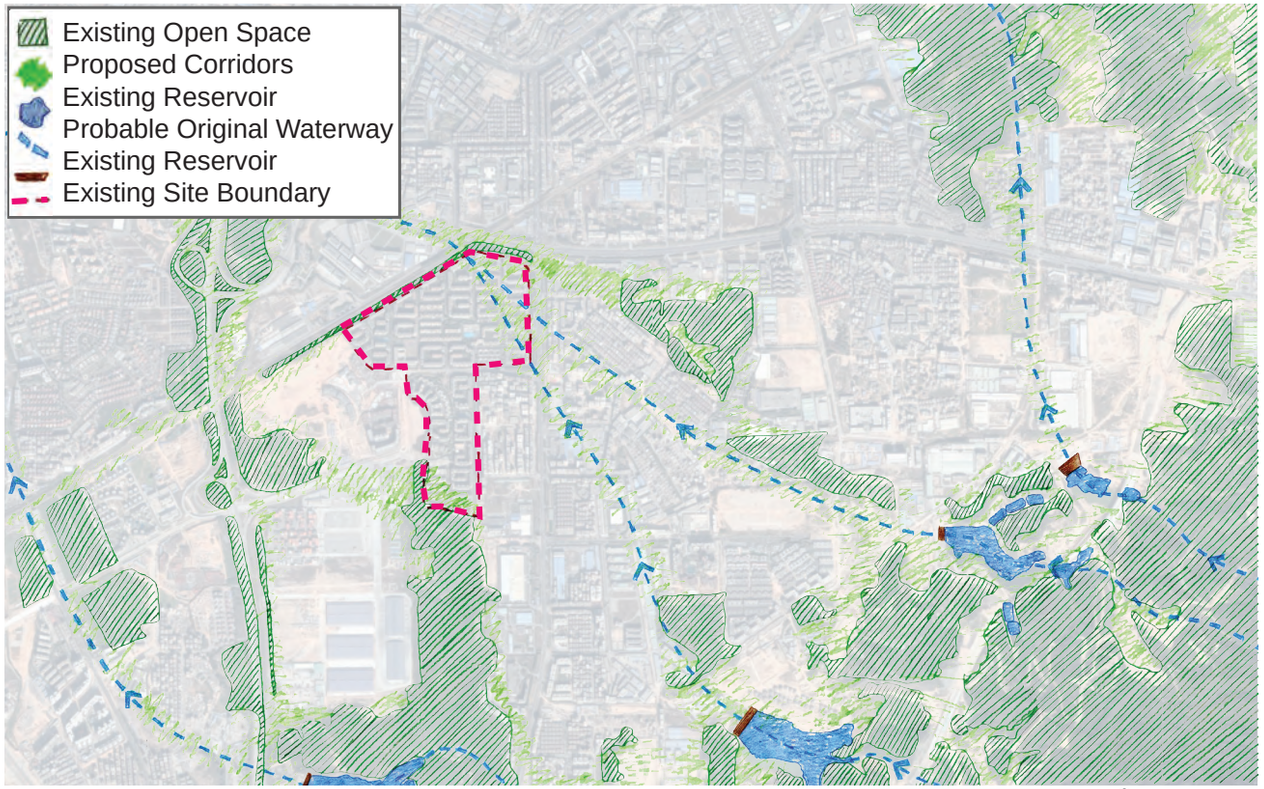
Aerial photo courtesy of Google Earth.

Bantian District Natural Systems

Traces of Waterways

Restoring original waterways is a powerful tool for enhancing the function of natural systems in an urban area. This restoration concept was used as the basis for site planning from a natural resources and systems perspective.

Original streams and waterways can be inferred from current locations and angles of nearby dams and reservoirs, as well as orientation of several older villages close by. Existing roads, which are often built in valleys, can also indicate where streams originally ran. This methodology suggests that a stream ran through the northeast corner of the Wonderland boundary.



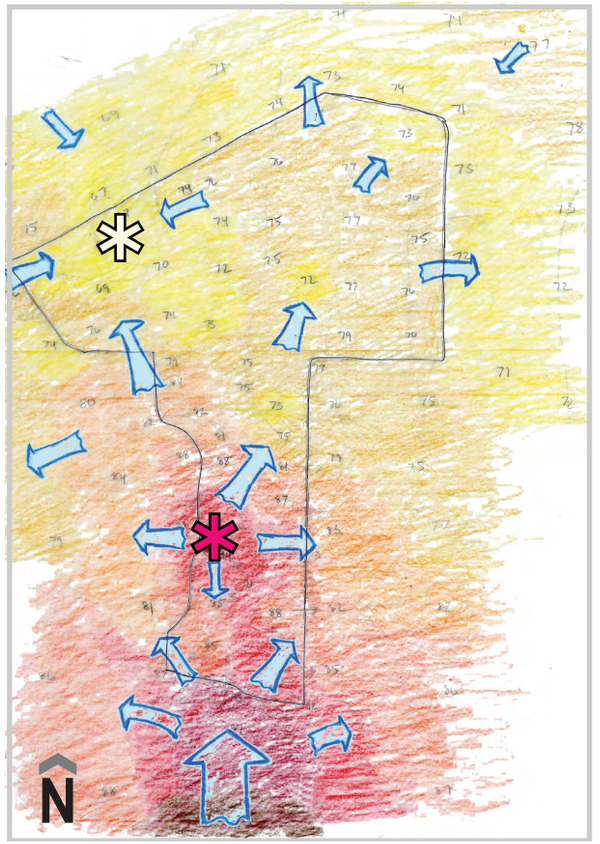
District Open Space and Original Waterways

Aerial photo courtesy of Google Earth.

Wonderland Site Elevation and Drainage

Current Topography

In the case of the Wonderland site, current topography is somewhat altered from its pre-existing natural state due to the minor grading that took place during development. Spot elevation checks reveal that present topography and drainage patterns still follow the basic form suggested in the 1982 sketches and the district open space maps, as shown in the previous sections. The Wonderland site slopes downhill from south to north and indicates a low channel in the north-east corner. The low point marked on the northwest side has a slight depression that does not correspond to any identifiable pre-existing condition.



Elevation (meters)

- 65 - 69
- 70 - 74
- 75 - 79
- 80 - 84
- 85 - 89
- 90 - 94
- 95 - 99
- 100 +

Highest Point on Site

Lowest Point on Site

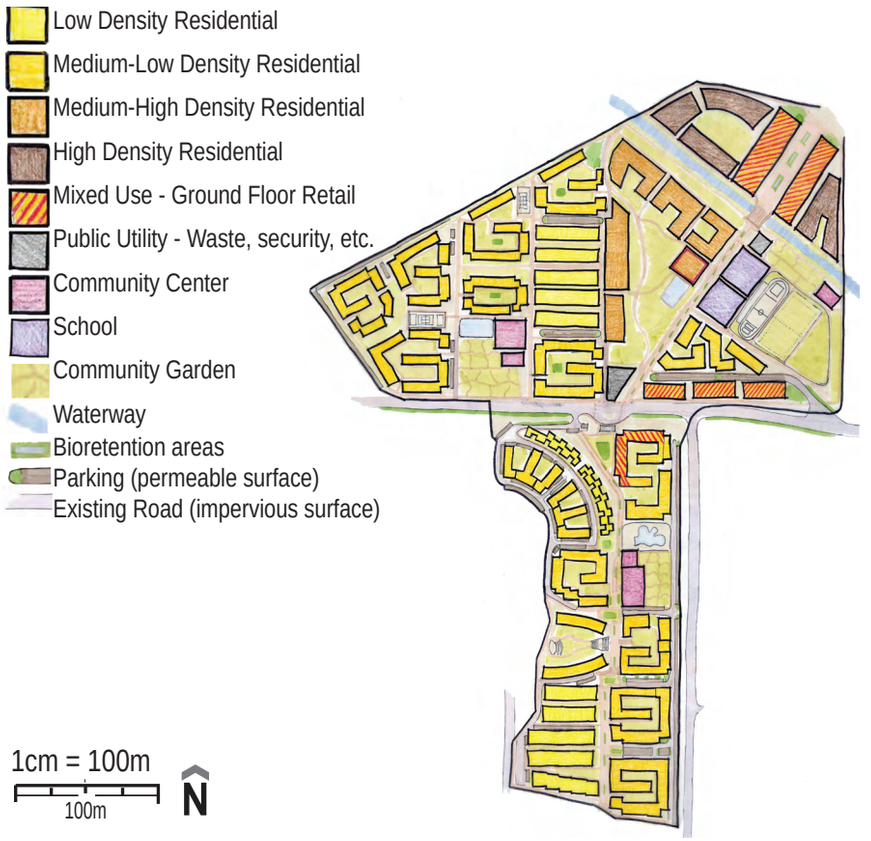
SITE PLANNING

Redesigning Wonderland Around a Restored Waterway

Incorporating Tools for Natural Systems

Principles of low impact stormwater management, waste management, and environmental education should be merged into the site planning process to maximize environmental quality goals. The restoration of a natural waterway provides one way to achieve these goals.

The Wonderland site is an opportunity for restoring a natural waterway. As indicated in previous sections, pre-existing conditions reveal the traces of a former water feature. Using this history as the basis for applying the restoration concept, site planning must also consider location of bioretention areas and other landscaping features in addition to more traditional designs.



Environmentally-Oriented Site Planning

Development should consider natural features as well as the surrounding urban context. In the Wonderland example, a planned transit station at the northeast corner of the site would affect density and development decisions. Higher density housing, schools, retail, community gardens, and open space should then be clustered at the heart of the site.

Natural features are a major amenity and can draw public interest to a community space, as well as act as a natural transition toward private areas. In this example, the river acts as a natural separation between the public uses and private neighborhoods, but both groups can enjoy the waterway.

Site Planning Highlights

Balance of Uses

In addition to site orientation, uses may change in relation to density and location of natural features. For the Wonderland site example, this refers to the uses map (on right):

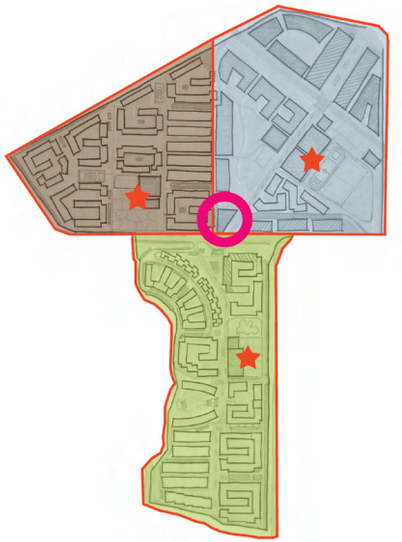
Blue: Mixed-use buildings with commercial and retail spaces serve non-residents and residents alike.

Brown: Relatively unchanged from the original site, the school has been moved to the blue section for easier access.

Green: Suggested intervention is transforming the existing school into a community computing center.

Stars: Each of the distinct sections within the site is allocated a central community space.

Circle: Centrally located trash sorting and recycling center.



General Site Planning Implications:

Mixed use, high density, and high traffic community amenities should be focused near transit. Public utilities should be central to the entire site. Each distinct portion of the site should have its own centrally-located community center.

River & Central Corridor

River: Restored to original river site, flowing at an angle to the existing Wonderland grid. Consequently, this northeastern section of the site is redesigned around the river's orientation to maximize views and use of the river for a community garden.

Central Corridor: Placed perpendicular to the river pathway and oriented towards the proposed transit stop. Main commercial area along this central corridor. Schools relocated to this central corridor to increase ease of access. Recycling center located at the end of the corridor at the heart of the site.

General Site Planning Implications:

Waterways can form strong boundaries, but can also be a strong asset when the site responds to their location. Central corridors should attract the highest pedestrian traffic and intensity uses while providing accessibility to the remainder of the site.

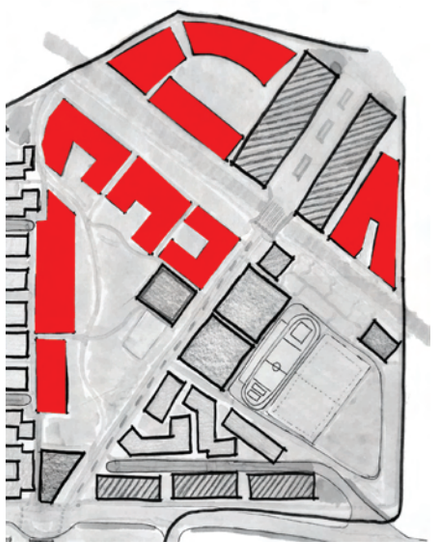
Site Planning Highlights (Cont'd)

Transit Oriented Development and High Density

High density housing is proposed for the northeast corner of the site to respond to the new transit station nearby. Additionally, greater increases in open space on the site require higher density housing. Proximity of the transit station will increase real estate values, making such high density structures marketable while also compensating for lower densities created by increeased open space networks. These residential structures will resemble The Metropolitan, another Vanke development.

General Site Planning Implications:

To encourage use of public transit and to maximize real estate values, higher residential densities should be placed on the portion of the site with best transit access.



Community Spaces

Three primary community spaces will serve each of the three major portions of the Wonderland site. Each will have its own community gardens and open space. The northeastern space is geared towards youth, as it is adjacent to the schools and is also largest to accomodate the high density housing nearby. The western space is a community center for the rest of the Wonderland site. The southern community space is designated as a computing center to serve the entire Wonderland site.

General Site Planning Implications:

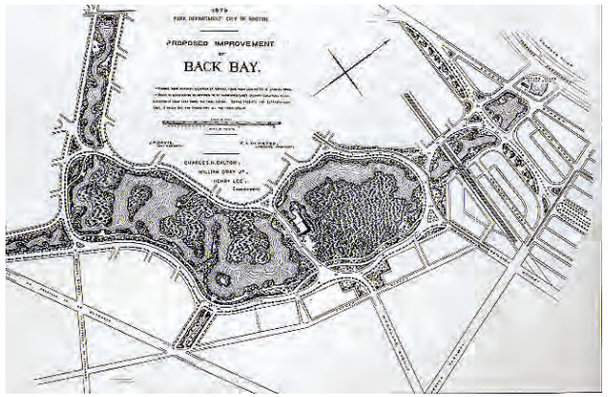
Distinct community spaces for varying population demographics within a site can better address the needs of residents.

Case Study: Boston's Emerald Necklace

A Boston treasure, famed landscape architect Frederick Law Olmsted's urban park restores the Muddy River and functions as a water management system in the heart of this city. The riverway and open space provides a natural filtration and flood prevention system. As with the theory of the times, such an urban park also functions as the "lungs of the city" and allows a place of quiet escape and reflection.

The graphics immediately to the right provide a map of the Emerald Necklace and two photos of the same location, one during the river and nature restoration process, and one many years later after vegetation reached its maturity. To the far right, the images show the Back Bay portion of the network as planned and fully developed.

Slides courtesy of MIT Rotch Visual Collections.



STORMWATER MANAGEMENT

Rationale for a Natural Approach

Introduction

The tools discussed in this section consist of implementing Low Impact Development (LID) best practices aimed at reducing and managing stormwater runoff. Specifically, these tools are:

* **Installation of vegetated buffers and/or filter strips**

* **Installation of dry bioretention ponds**

* **Increased use of permeable pavement**

* **Reconsideration of site design to minimize runoff**

Vanke recognizes the importance of conserving potable water and collecting and reusing rainwater, and rooftop water harvesting technology has been put in place at Wonderland. Rainwater is collected from rooftops and channeled into underground cisterns. However, this initial installation does not utilize various LID stormwater management tools that can collect and filter *ground* rainwater more effectively while at the same time improving the ecological functioning of the site.

Assumptions

It is likely that within a decade or two, new developments will be required by the government to collect and reuse anywhere from 60 to 80 percent of the stormwater that falls on the site. By incorporating comprehensive stormwater management tools into new developments and making some simple retrofits to existing ones, developers in Shenzhen can use water resources more efficiently and mitigate some of the negative environmental impacts of growth and development.

An example of Wonderland's current drainage system. Water flows off pathways directly into the municipal system. Source: Molly Mowery

Goals

Implementing LID stormwater management tools:

* **Enhance environmental quality of the site** and surrounding area by replicating pre-existing hydrologic conditions on the site through improved design. This process helps recharge aquifers and improve groundwater quality.

* **Minimize the amount of unfiltered stormwater discharge**

* **Reduce on-site water needs** by harvesting and recycling rainwater in the following ways:

1) Expand existing rooftop rainwater capturing system to more of the site

2) Develop a natural system for capturing, filtering, and then reusing stormwater that falls to the ground

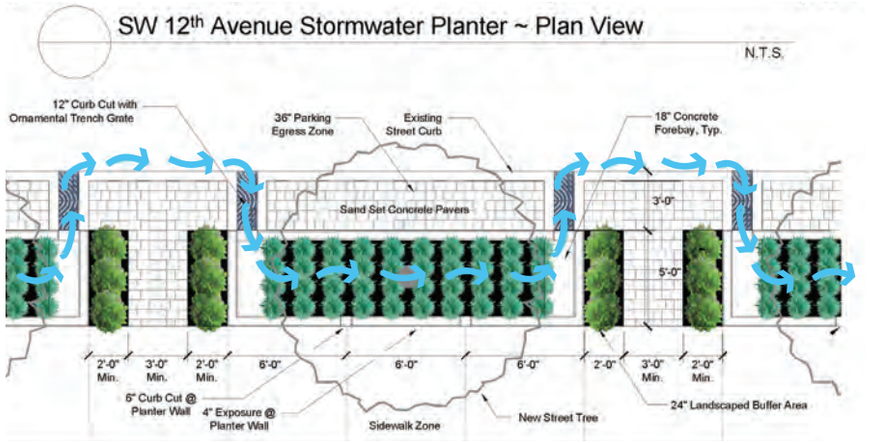
3) Lower landscape maintenance costs and increase residents' comfort during times of heavy rainfall by managing stormwater runoff naturally and efficiently.

Low Impact Development Tools

Bioretention

Bioretention ponds are landscaped depressions into which surface runoff is directed. Filled with porous soil and mulch and planted with native hydrophilic plant species, the ponds remain dry at most times in order to avoid standing water. Ground runoff is naturally treated and cleaned through the ponds' filtration process. The water is then allowed to seep back into the underlying soil and recharge the water table or collected and stored via a connecting pipe for reuse on site. This latter option is preferable for Shenzhen's water conservation needs.

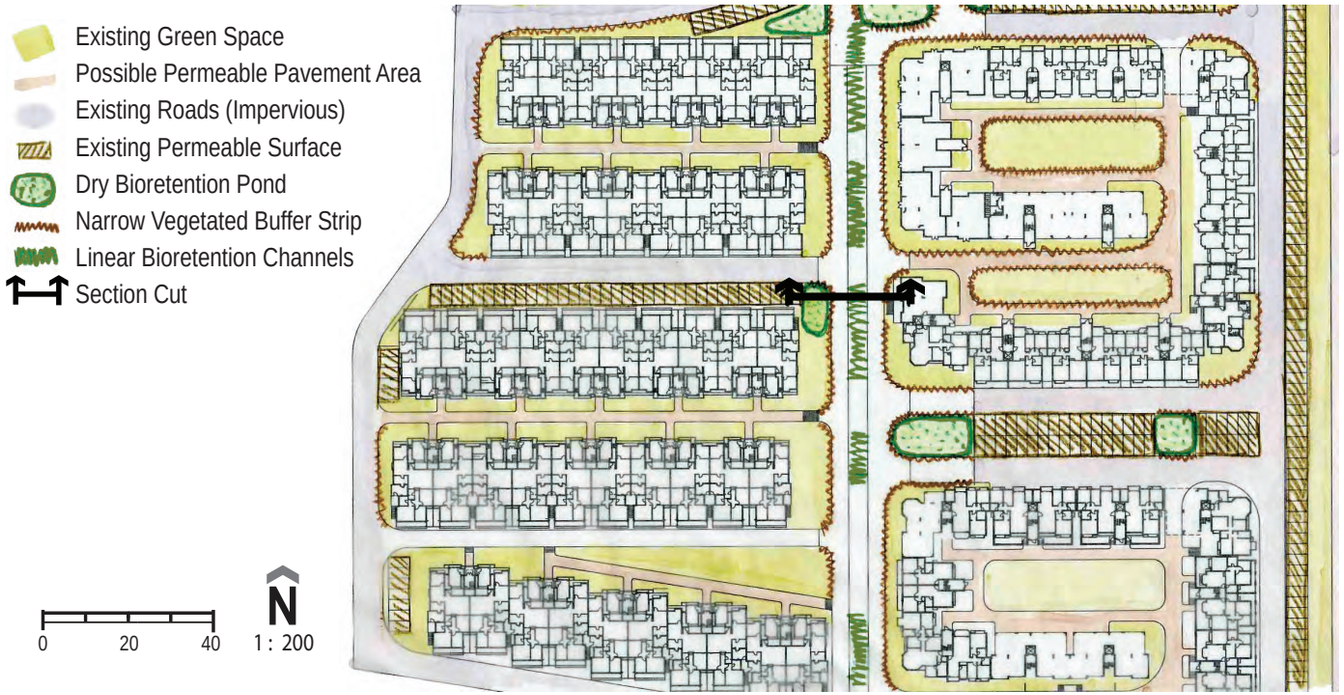
Because of Shenzhen's monsoon climate, bioretention ponds will be most effective when linked together into a system. Water is funneled downhill through adjacent ponds as each one reaches capacity. This type of linear system is well suited to the Wonderland site, where wide, gradually sloping pedestrian paths can accommodate their installation and generate the type of ground runoff this tool is fit to handle. Ponds are also equipped with an underground outflow drain that can pass the water through to the municipal system in the event of massive flooding. When used in conjunction with the other tools, bioretention ponds can help manage large volumes of runoff during most large storm events.



Linear Bioretention System. Plan shows how water cascades through a system of connected bioretention planters after each one fills to capacity

All images on this page represent the SW 12th Ave. Green Streets project in Portland, Oregon. Source: Kevin Perry and City of Portland Sustainable Stormwater Management Program.

Implementing LID Stormwater Management Tools On Site



A System of Tools

Linked, linear bioretention ponds are just one component of an integrated low impact stormwater management system. The site plan (shown left) and corresponding section (shown on the following page) illustrate how tools are combined for maximum effectiveness:

* The linear ponds break up the impervious surface of the pedestrian walkway and treat the majority of sheet flow in the drainage area.

* Larger bioretention ponds are placed at the ends of surface parking areas, which capture runoff in large storm events that is not drained by the permeable pavement. **Total area devoted to bioretention occupies 5 to 10% of the whole drainage area.**

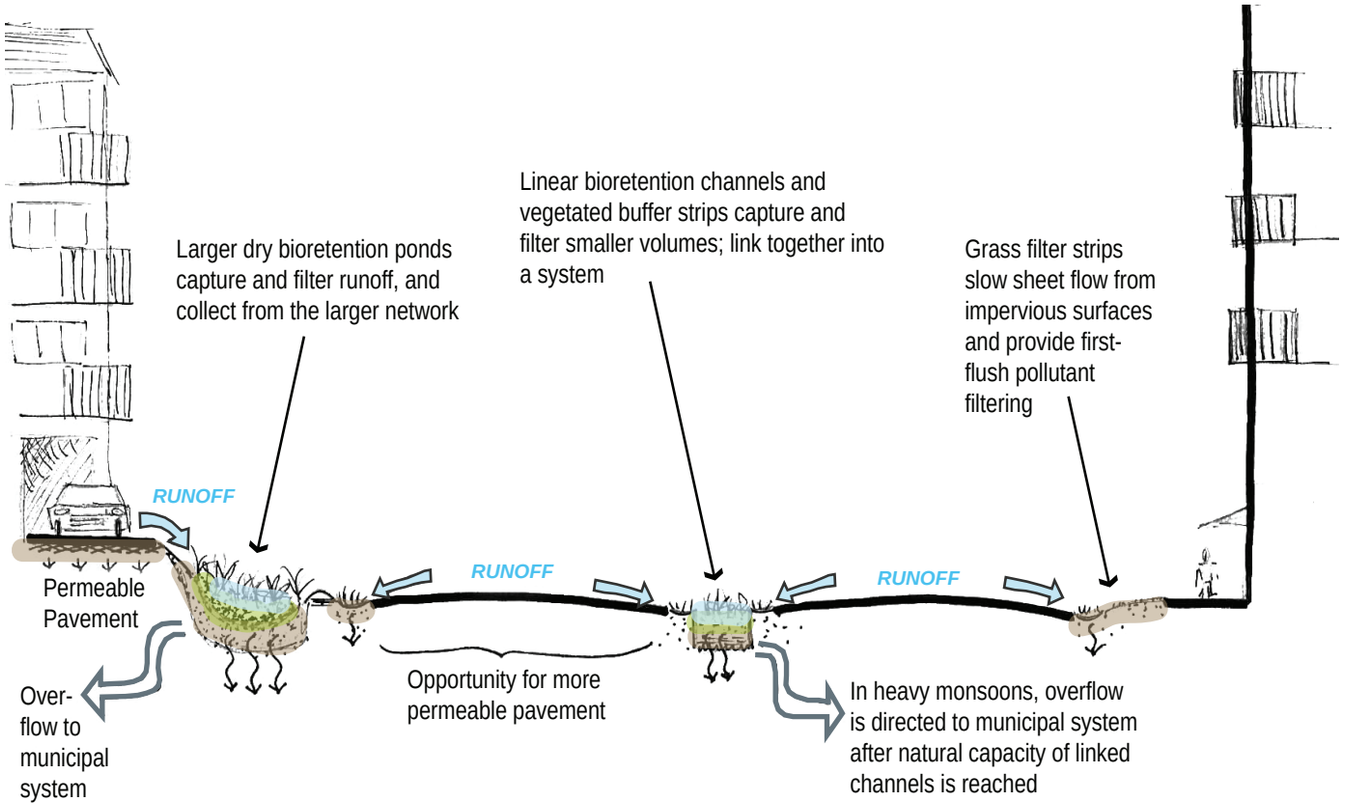
* Gently sloping grass areas, known as grass filter strips, border

Integrating Stormwater Management Tools On Site

impermeable areas to catch and slow the first flush of stormwater before it reaches a bioretention area.

* Permeable pavement is used on the walkways within the courtyards, as well as in parking areas. Courtyards and paths are landscaped such that paths are slightly convex. Runoff drains to the edges and into vegetated buffer strips to help control flooding and maintain usability in major storm events.

Runoff absorbed by grass and vegetated filter strips will not be recaptured for reuse on site, instead of re-entering the local hydrologic system. However, runoff that drains to bioretention areas may be captured and reused, and it has the benefit of pollutant filtering by the soils and plants.



WASTE MANAGEMENT AND RECYCLING

Recognizing the Role of Waste in Environmental Quality

Waste Solutions

Shenzhen is not unique in facing waste management issues. With its rapid urbanization, top-notch waste management practices are needed to ensure a sustainable future. As more countries recognize the need to address climate change, land use constraints, and pollution, waste management is transforming into a rigorous program of mandatory recycling, zero landfill waste, waste to energy recovery programs, and eco-industrial parks. Other initiatives, such as composting and the innovative reuse of materials, are being used as a means to address waste management issues.

Photo: Molly Mowery

Waste management solutions are the responsibiliy of the government, businesses, and consumers. This includes the development community and its residents.

A common means of approaching waste solutions is illustrated by the Waste Hierarchy concept (as shown on the right). This diagram prioritizes the strategies that should be used to reduce the human generated impact of waste on the planet. Ultimately, avoiding and/or minimizing consumption and production of waste is the best way to conserve resources. However, other methods such as reuse, recycling, recovery, and disposal must also be acknowledged as alternative methods for handling waste. Within each category, a range of tools can be employed.

* *Avoidance and Minimization* require industry and businesses to design alternative packaging which reduces the amount of new materials required. The use of composting, appropriate landscaping practices, and consumer education also contribute to waste reduction.

* *Reuse* programs retain the value of a product while avoiding reprocessing or remanufacturing. This strategy conserves energy and only requires minor pre-treatments such as washing or painting. Industry practices include the recovery of demolition materials, durable packaging, and other appropriate goods.

Adapted from www.wastenet.net.au

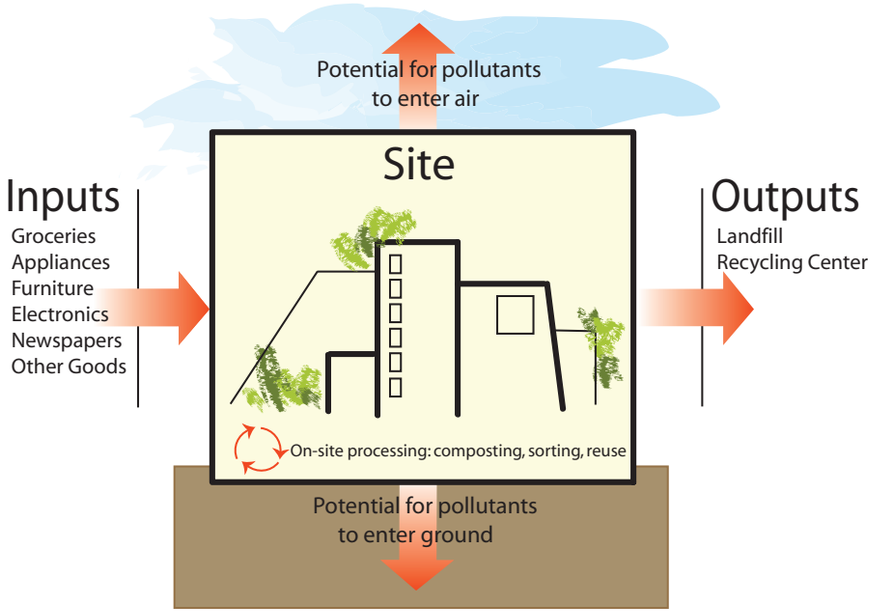
* *Recycling* also has considerable value but requires raw materials to be broken down and reprocessed before they can be turned into new

Recognizing the Role of Waste in Environmental Quality (Cont'd)

products. This process entails the ongoing collection and sorting of appropriate materials, such as glass, newspaper, plastics, and aluminum.

* *Recovery* of waste materials is a process that employs chemical, biological, or thermal means to break down materials into usable forms of energy and other products.

* *Disposal* of waste is the least preferable way of handling waste. However, some landfilling of materials may still be inevitable as communities transition toward a zero-waste goal. Progressive policies, such as Germany's recent "Ordinance on Environmentally Compatible Storage of Waste from Human Settlements," can greatly reduce the amount of landfill space required by banning all forms of untreated biologically degradable waste.



This diagram shows typical forms of consumer waste and potential paths once waste enters a residential site. Residents can reduce their consumption levels, while property managers can support on-site processing, composting, recycling, and reuse programs. When not handled properly, waste can enter the ground and air, increasing pollution and landfill requirements.

Site Considerations

Residential developments hold many opportunities for incorporating best practices in waste management.

From the developer's perspective, circulation and access decisions should consider routes for household recycling bins and larger sorting facilities; composting features should be integrated into landscaping plans; and innovative construction and demolition techniques should be utilized.

Property managers should facilitate recycling programs by offering resident education programs, proper maintenance and distribution of bins; managers should also require on-site business participation.

Finally, residents must fully engage in waste management and recycling solutions in order to guarantee success.

COMMUNITY EDUCATION

Why Educate?

Introduction

In order for the conservation and management of limited resources to be truly successful, cooperation at all levels of the community will be needed, from the residents in their own homes to government policies that set minimum standards or restrict flows of additional resources. Community education programs increase awareness to help residents better manage and conserve those resources.

Developments with high densities have the potential for such practices to bring significant positive impacts. While education can be applied to a variety of topics, this section focuses on water management, recycling and energy conservation.

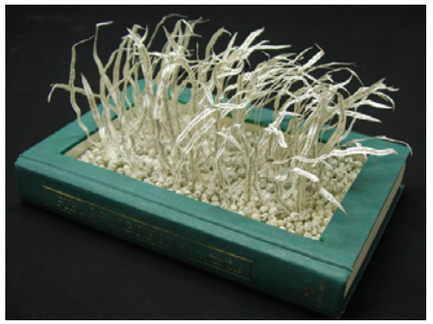
Assumptions

Energy, virgin material, and water shortages will cause increased costs to make resource conservation economically viable.

In addition, stringent government requirements will provide incentive for developers to fund an educational tool to encourage best practices

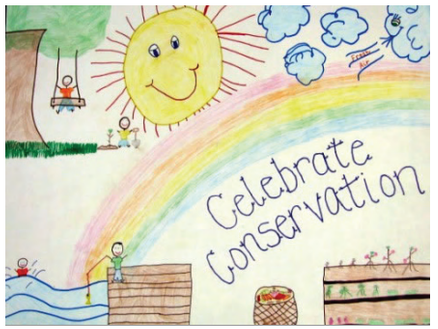
Goal

Environmental and economic benefits for residents and the region can be attained by educating a community about best practices in resource conservation and management.



"Field of Greens." Reused book from the Portland Public Library. Source: http://www.meca.edu/Meca_Galleries/Altered_Book.aspx

TRASHed: The Art of Recycling. Decorated recycling bins to encourage recycling. Source: www.globalinheritance.org/trashed/



National Conservation Poster Competition K-1 1st Place Winner, Will Moore. Source: www.nacdnet.org/outreach/awards/poster.htm

Surfacing material made from old sneakers. Nike Reuse-A-Shoe Program. Source: www.nike.com/nikebiz/nikebiz.jhtml?page=27&cat=reuseashoe&subcat=us-surface

Education Strategies

Tools

A myriad of community education and outreach strategies can be used alone or in various combinations. A table of potential strategies is outlined here. These strategies should be considered as part of a larger education and awareness program.

Table of Tools & Existing Examples

Outreach Strategy	Description	Examples
Active Participation		
Schools	Excellent location to teach children lifelong habits which can also be spread to their families.	Green Schools Program (Maryland Association for Environmental and Outdoor Education), Eco-Schools
Public Art Programs	Art activity that is accessible by all age groups, related to resource management. Engenders a sense of ownership and responsibility for that aspect of resource management.	TRASHed :: Art of Recycling
Community Gardens	Common garden space to practice using best management skills.	Seattle Tilth
Visible Recycled Products	Recycles and reuses material. Recycled products used in a visible, memorable, and aesthetically pleasing way to create an appreciation of, respect for, and awareness of recycling.	Nike Reuse-A-Shoe Program, "Long Overdue: Book Renewal" (Portland, Maine Public Library), The Heidelberg Project
Incentives		
Rebates	Providing clear economic incentives for best management practices.	Austin, Texas Rainwater Harvesting Rebates, Go Solar California! Solar installation rebates.
Competitions	Raises awareness among participants. Attracts media attention and proves best management practices are not only possible but can be achieved to a high level.	National Conservation Poster Contest (National Association of Conservation Districts), Residence Challenge 2007 (Ohio State University), Harvard Campus Energy Reduction Program Energy Competition.
Passive		
Signage	Raises awareness and directs resident behavior, providing information and guidelines for action.	City of Bothell and Chesapeake Bay stormwater drain stenciling.
Informational Boards and Booklets	Accessible educational information and materials that are visible and can be used to disseminate information to every resident.	The Texas Manual on Rainwater Harvesting, Bus Stop Information Board (Massachusetts Bay Transit Authority)
Technology	Incorporates use of the internet, electronics and computers to facilitate education	Wikipedia, Green Touchscreen

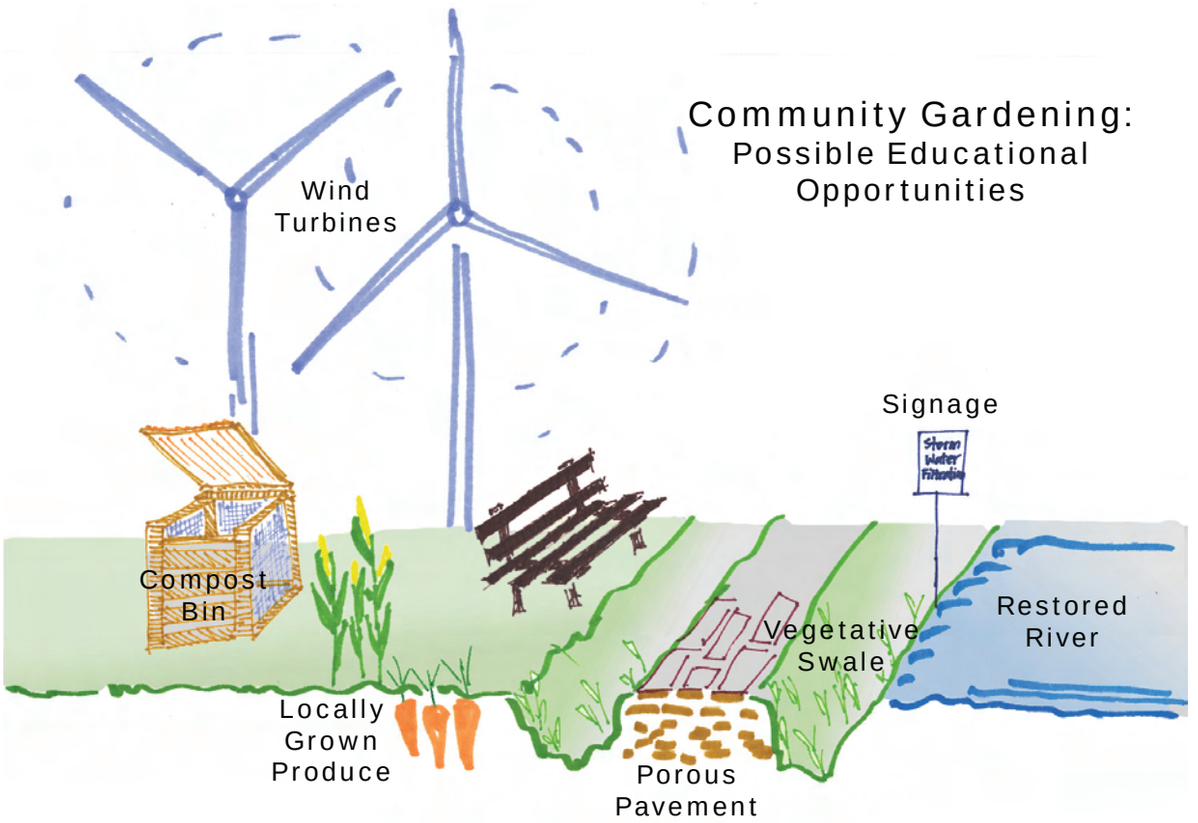
Source: Appendix Section -- Community Education Tools

Vignette: Community Gardens

Community gardens are places where many resource management best practices are easily applied and practiced. Often serving as a common ground in neighborhoods, these gardens are also a way to reach the entire community.

For example, the community garden is an ideal place to locate composting bins for waste management. The community garden can also be a natural location to demonstrate how water is managed to prevent flooding, to filter stormwater, or to harvest rainwater.

The following vignette depicts potential strategies for incoporating resource management into a community garden to educate residents and students in the adjacent school.



Further Information

Image courtesy of Google Earth

TOOLS FOR ACTION

The following section provides tools for the implementation of sustainable development in Shenzhen. In order to make them useful, they were organized according to a format based on the Atlanta Regional Commission's Regional Development Plan Guidebook, 2004. The tools were developed using existing research and experiences from places around the world. Adapting these tools to China's context will likely inspire new variations on the models presented here.

To help ensure the tools are implemented in relevant situations, each topic follows the following format:

* What is the topic?
* What are the tools needed?
* What are the goals of using these tools?
* On what scale does each tool apply (district, site, building)?
* Who will use each tool (developer, government, residents)?
* How do you measure the cost effectiveness?
* What is required to make each tool work?
* What are the best practices?
* What research already exists, and what further research is needed?

LAND & TRANSIT PLANNING

Stephen Crim

Shenzhen is a dynamic city within a dynamic region, and as it continues to grow, its people must be able to move different areas of the metropolis in order to conduct their lives. During the 20th century, many cities and nations chose policies that promoted the private automobile as the primary way to allow movement between places. However there is now recognition that private automobiles bring myriad negative effects. Their use promotes inefficient consumption of land and other natural resources, disinvestment from existing urbanization centers, environmental pollution, and in many cases, unattractive physical surroundings.

Chinese citizens are currently turning to private automobiles as the answer to their transportation needs, making China the second-largest automobile market behind the United States,[1] and the Chinese government has set out to construct a national highway system longer than the United States' by 2035.[2] Shenzhen already has the highest rate of car ownership in China (in 2002 there were 18.5 cars for every 100 households compared to 1.14 for the nation as a whole,[3] a rate which will continue to grow as the city's residents grow richer, and as the central government continues to promote the automobile industry as a key economic sector. In 2004, there were 537,000 vehicles on Shenzhen's roads, an increase of 23.6% over 2003, and follows the national trend in increased automobile ownership that is projected to place China ahead of the United States in carbon dioxide emissions by 2025.[4] In 2004 around 40% of evening rush-hour trips in the city center averaged speeds of less than 20 kilometers per hour,[5] a situation that must be improved if the city is to grow and prosper economically.

By encouraging public and non-motorized transportation choices, cities and regions can provide the access and ease of movement that individuals demand while minimizing the negative results of automobile dependence. While the automobile will play an important role in the 21st century—as it does even in a center of public transit like Hong Kong—it is important to manage the growth in auto usage so that it is only one of many transportation alternatives. While the Shenzhen Planning Department has acknowledged the need for a diverse set of transit options and land use policies that support these options, this document presents key strategies to achieve transit diversity and land uses that support that diversity. In addition, it provides many examples from which Shenzhen can draw practical lessons. Finally, because reducing automobile dependence and increasing transit use are not simple, additional resources are listed at the end of this section.

The Tools

Coordinated transportation and land-use planning

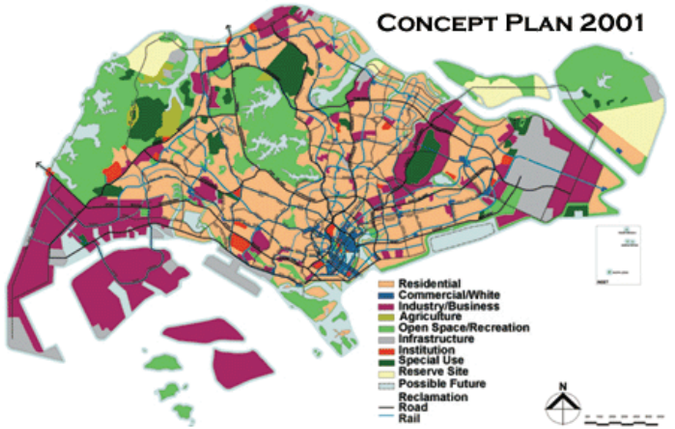
At what scale? Region, city, and district levels.

Who acts? Government

Implementation Techniques

* Growth limits that restrict building to certain areas
* Land takings that reorganize existing land use
* Incentives for private developers to build along corridors

Best Practice Examples



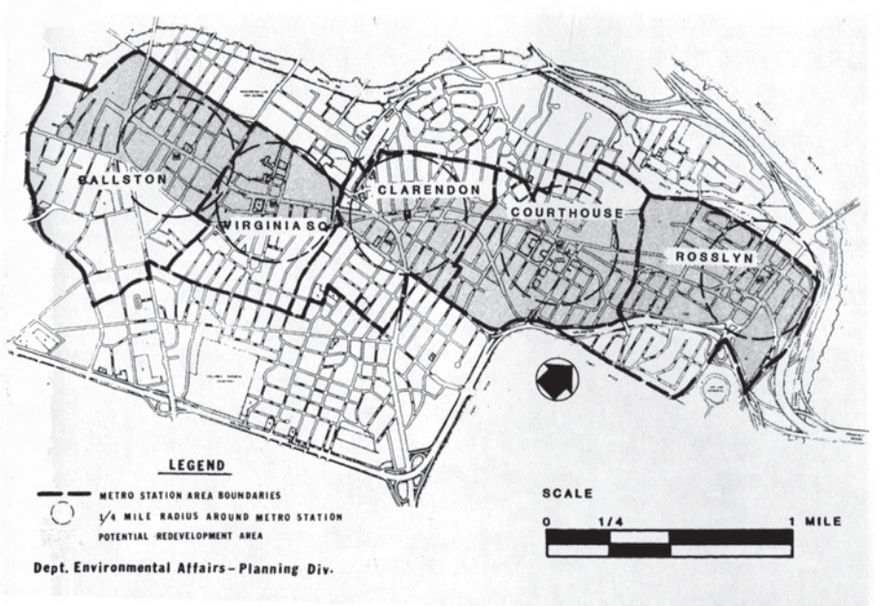
Singapore's latest Concept Plan from 2001 (Source: URA 2001)

* Singapore Concept Planning

* Urban Growth Boundary in Portland, Oregon, USA

Shenzhen's Comprehensive Transportation Plan for 2010 calls for the unification of land use and transportation planning.[6] Efficient public transportation is predicated on the coordination of development with the transit system. In order to achieve that coordination, transit routes should be established and then development should be located around those routes in order to maximize system efficiency, profitability, and attractiveness to riders. One of the leaders in this field is Singapore, which has planned development around a bus and rail system, as described further in the case study below.[7] Other urban areas, such as Munich, Germany, and Arlington, Virginia (USA), channel the market through incentives that encourage private developers to locate projects along transit corridors.[8] Although it is optimal to implement an integrated land-use and transportation policy before rapid growth occurs, it is possible to re-orient growth into concentrated corridors

Arlington County, VA, USA has channeled high-density development along the Orange Line of the Washington, DC metropolitan subway system (Source: Schrag 2006)



An artist's rendering of future development along an extension of the Kowloon-Canton Railway's Ma-On Shan Line in Hong Kong (Source: KCRC 2006)

even after significant automobile-based growth. In 1997, Portland, Oregon, implemented an urban growth boundary that restricts new development within certain zones as part of an overall strategy of increasing public transportation ridership.[9]

Unified multimodal transit network

At what scale? District level.

Who acts? Government

Implementation Techniques

* A state corporation builds, maintains, and operates all transit service.

* Private developers build and operate transit with government oversight and coordination.

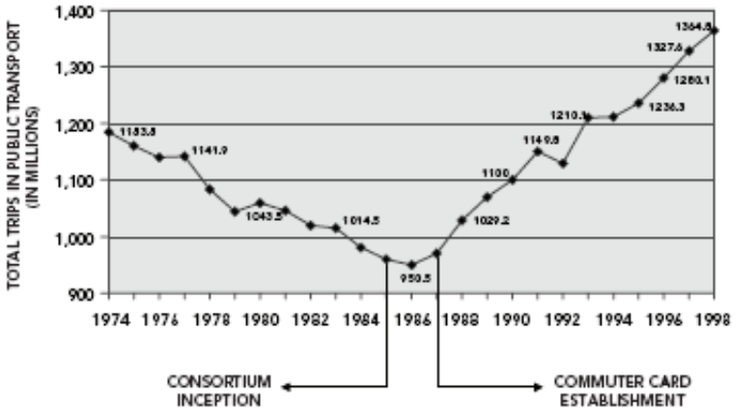
Best Practice Examples

* The Munich Transport Union (MVV) of Munich, Germany

* The Public Transport Council (PTC) of Singapore

A well-functioning public transportation system should provide service to locations throughout a metropolitan area within a single unified system. To be attractive to users, transit must be available within a five-minute walk, which is approximately 400 meters on average. A multimodal network of bus and rail corridors can achieve this level of service across a metropolitan area. For example, local buses could stop at 400 meter intervals, bus-rapid-transit (BRT) every 800 meters, and trains every 1-1.5 kilometers.[10] Completing the system would be a taxi network that could transport customers between any two points. The Shenzhen Comprehensive Transportation Plan calls for such a system,[11] including an expanded metro and a BRT, which would yield a variety of transportation choices for all residents.

Integration and coordination is the key to success for a multimodal system. The system design—fare collection, scheduling, route alignments, and station design—should



Following the integration of the transit system in Madrid, Spain, transit ridership increased after years of decline (Source: World Bank 2002)

1 Netz. 1 Fahrplan. 1 Tarif.

Munich's MVV: One Network. One Timetable. One Ticket (Source: MVV)

ensure that transfers between different transit modes are convenient. Such coordinated design among different modes and lines will create a seamless transportation network. For example, the Munich's regional government coordinates timetables and manages a shared fare collection system for all of the transit modes, including an urban metro system (the U-Bahn), suburban commuter rail (the S-Bahn), buses, trams, and light rail.[12] By contrast, public transportation in the San Francisco area is governed by separate agencies, making transfers between the commuter rail, streetcar, and bus systems inconvenient and costly for users.

Regional coordination does not require government provision of all transit service. In Munich, transit infrastructure is owned publicly, while private firms operate the service.[13] In Singapore, private operators provide bus service under quality and frequency standards set by the government.[14]

Remove hidden subsidies for automobile use through new tools

At what scale? Region, city, and district levels.

Who acts? Government

Implementation Techniques

* Government can implement road tolls, congestion pricing, car purchase taxes, and parking charges.

Best Practice Examples

* Car purchase and use policies in Singapore
* Congestion Charge Zone in London, UK
* Congestion Pricing Plan for New York, NY, USA as proposed in NYC2030

In many countries, automobile use is effectively subsidized through government policies like price caps on gasoline, taxpayer-financed highway building, and zoning that requires free parking. As a first step to discouraging auto usage, subsidies like these should be abolished. In addition, because drivers impose costs on others through increased congestion and pollution, government can charge drivers for these costs through high gasoline taxes, tolls for road construction as well as congestion pricing for peak-time road use, and significant licensing fees for new cars. The revenues generated from such policies could then be used to finance public transporta-

A proposal for congestion pricing in Manhattan, New York City's central business district (Source: PlaNYC 2007)

A typical sign demarcating the Congestion Zone in London (Source: Reform)

tion or improvements to pedestrian spaces, thereby encouraging transit ridership and non-motorized travel.

Recently, London has received a lot of attention for its congestion-pricing scheme. However, it is not the first city to manage car usage. Singapore has been controlling auto usage for many years through purchase and licensing taxes, an annual import quota that requires potential buyers to bid for purchase rights, and a congestion-pricing system. These policies have suppressed growth in automobile ownership to 3% per year and have kept the roads free of congestion.[15]

Locate employment, housing, parks, and civic uses within walking distance of transit

At what scale? Region, city, and district levels.

Who acts? Government and developers

Implementation Techniques

* Transit agency develops land itself

* Areas are zoned to create mixed use

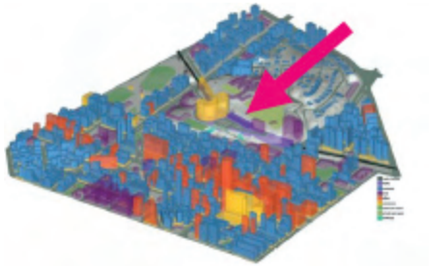
* Planning bureau designates special transit development zones

Best Practice Examples

* Property development by the Kowloon-Canton Railway Corporation (KCRC) and MTR Corporation of Hong Kong, China

* Transit-station area zoning in San Diego, California, USA

A good mix of land use around transit stops is necessary for encouraging public-transit use.[16] Such a mix reduces the need for motorized transit around the station because of the close proximity of different amenities. Locating offices near apartments will



A mix of land uses around Hong Kong's Mong Kok Station. The station is indicated by an arrow (Source: Linear City Research 2005)

reduce commute times for people living near their workplaces; locating retail near residences and offices enables people to walk to or bike to shops. Moreover, locating these mixed-use clusters around transit stops makes the transit more attractive for users throughout the region. This pattern of clustering will reduce the attraction of using cars for daily trips.

The experiences of various cities models demonstrate how land uses

can be mixed around transit stops. Transit providers can develop the property around its stations. In Hong Kong, the Kowloon-Canton Railway Corporation (KCRC), a transit provider, develops property to provide rides for its lines and to raise money for transit maintenance and expansion. The KCRC manages around 10,000 apartments, 10,000 square meters of commercial space, 3,500 parking spaces, and 600 in-station retail outlets. It is now developing 3.4 hectares of land at its Wu Sha

An aerial view of Bethesda's mixed-use downtown, centered around a metro station (Source: BeyondDC 2006)

station with over 2,000 apartments and 4,000 square meters of retail in seven towers 38 to 45 stories high.[17]

In the United States, the Washington Metropolitan Area Transit Agency has worked with private firms to develop 30 sites near its Metrorail stops. The largest development is in Bethesda, Md., and includes a hotel, retail, and offices. This joint development has encouraged other development nearby and provides the agency with revenue through rent.[18]

Municipalities can also use zoning regulations to promote land-use mixing near transit stations. San Diego, California, used such a strategy to encourage developers to build nodes with retail, offices, and restaurants located around light-rail stations.[19]

Create high-quality spaces for pedestrian circulation and leisure use

At what scale? District

Who acts? Government

Implementation Techniques

* Government lays out the entire hierarchy of streets, from the smallest neighborhood roads to the largest arterials

* Government provides major arteries and coordinates private development of lower-order streets

* Cities build and maintain all spaces

* Cities build, then hand over maintenance to non-profits

* Cities require developers to build and maintain

Best Practice Examples

* New York City, New York, USA

A sidewalk with plenty of room for pedestrians (Source: Project for Public Spaces 2006)

* French Concession, Shanghai, China

* New Downtown at Marina Bay, Singapore

A pleasant environment will encourage people to walk and to use transit. The first element of a pedestrian-friendly environment is a network of sidewalks or pedestrian-only paths that can safely and comfortably accommodate walkers. High-volume sidewalks should be between three

One of the high-quality, inviting public spaces in Vanke's Wonderland community (Source: Vanke)

and six meters wide, allowing people to walk and pass each other comfortably.[20] Small blocks and frequent intersections shorten the perceived journey distances and allow more flexible walking paths. In addition, intersections enable people to gather organically. In the United States, blocks between 60 to 90 meters yield optimal pedestrian results, although blocks can extend to 150 meters without loosing their walkability.[21]

Chinese planners currently space roads between 700 and 1200 meters apart, leaving developers to develop road networks within their parcels.[22] Given this strategy of private and public development, government should ensure that that privately-developed streets are open to the public. As Singapore builds its new downtown at Marina Bay, it is requiring private developers to build an above-ground "travelator" moving sidewalk system in exchange for building rights. While private provision of pedestrian infrastructure reduces municipal costs, it requires strong oversight to ensure that multiple developers create a coherent network. Alternatively, the municipality can build all of the streets and attain all of its planning goals directly.

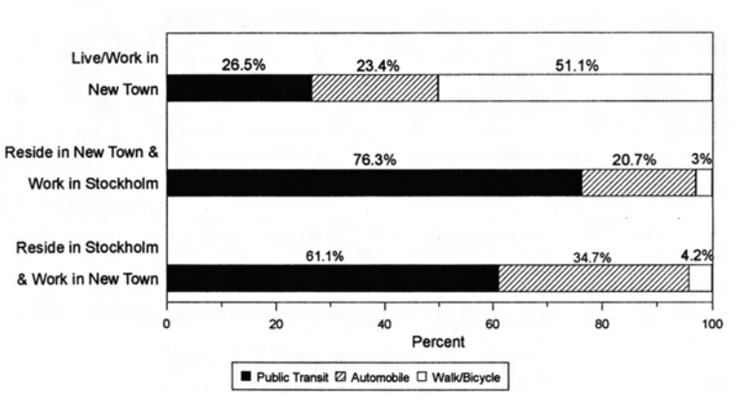
In addition to the pedestrian scale of street networks, aesthetically-pleasing and comfortable spaces will further encourage walking and transit use. The use of varied building and paving materials, landscaping, and human-scaled building walls at street level encourage foot traffic. Benches facilitate resting and socializing; ornamented lampposts provide light at night in a visually interesting manner. Trees, bushes and flowers can provide shade for pedestrians and beautify the natural realm. Porticos and other canopies can protect pedestrians from precipitation, wind, and heat. Together all of these features encourage an active street life.[23]

In the United States, the maintenance of management of many public spaces has been transferred to private organizations, including the Central Park Conservancy in New York City. Business Improvement Districts (BIDs), such as the Golden Triangle BID in Washington, DC, fund maintenance services beyond those

provided by the municipality. While private maintenance of such public spaces can relieve government of some financial obligations, government oversight is necessary to ensure public access and consistence maintenance. However, effective public maintenance requires significant resources, especially in harsh climates.

How Can We Measure the Effectiveness of Transit-Oriented Development?

A range of quantitative measures can measure the effectiveness of TOD policies. Levels of air pollution measure environmental quality, average peak-hour vehicle speeds measure congestion, trip-time surveys measure accessibility to employment and other sites, and mode-split surveys can gather information about the availability of transit choices. In addition to these direct measures, various measures of density of development—including the density of residences, offices and amenities—and different ways of measuring the mix of uses can indicate successful transit-oriented development policies.



An example mode split chart for Stockholm (Source: Cervero 1998)

What Is Required to Make this Tool Work?

Based on his examination of cities throughout the world, scholar Robert Cervero suggests several key principles to successful transit-oriented development:

* A growing economy enables the investment and the policy changes necessary to structure development around multi-modal transit networks.

* Clear and comprehensive goals for the region and the city provide a framework for coordinated land-use and transportation policies.

* Visionary leaders can shape the goals for growth, convince the public of their value, and coordinate multiple agencies and stakeholders in order to implement them.

* Government institutions must have the authority and capacity to carry out transportation and land-use policies.

* Active planning agencies can translate comprehensive visions into direct action.

* Competition between entities within the transit system can encourage individual actors to provide high-quality service.

* An ethos giving priority to

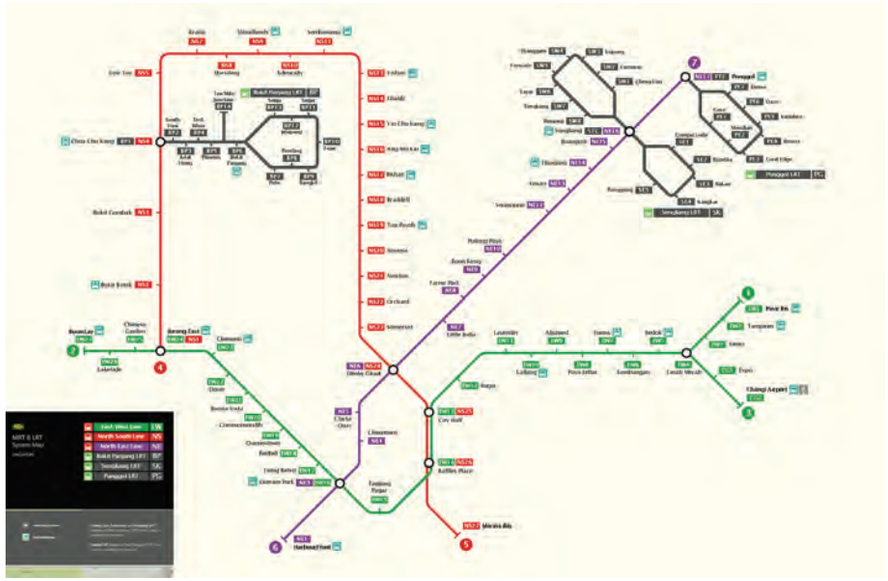
public transit can make transit useful and efficient for riders, beginning with small steps like providing traffic-signal priority to buses.

* A willingness to take small steps can move cities beyond a focus on expensive heavy-rail systems. Bus systems, bus rapid transit, and site-planning regulations that limit block sizes are essential components to transit systems; in addition, buses can provide transit service during the completion of large transit projects.

Detailed Case Studies

Singapore

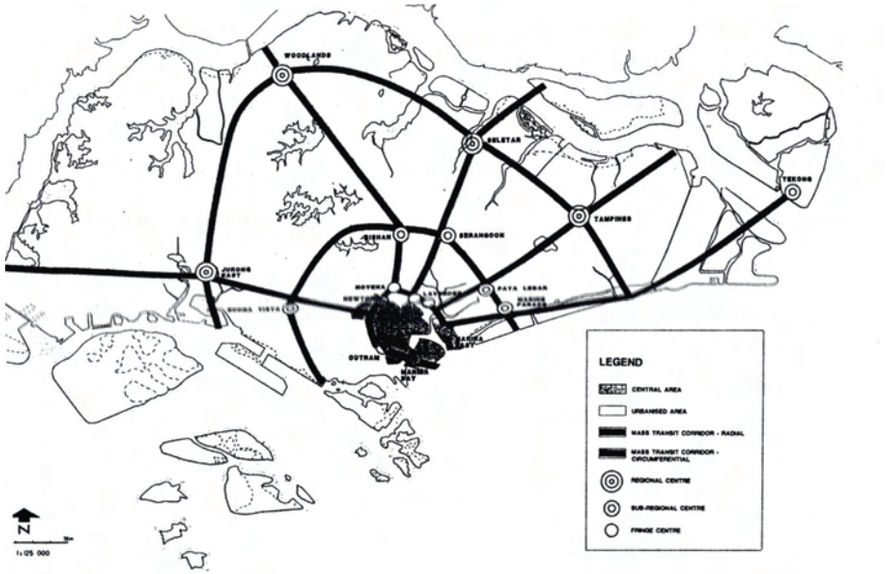
Singapore boasts a public transportation system that provides for over two-thirds of the motorized trips taken by the city-state's residents. A mix of policies implemented in stages since the 1970s has brought this success. With its highly-centralized, powerful government, Singapore has been able to restrict where and how urbanization occurs, locating development within reach of a first-class bus and heavy-rail system.



Singapore's heavy rail system, the MRT (Source: "Mass Rapid Transit (Singapore)" 2007)

In spite of rapid income growth, car ownership has been restricted through stringent ownership and use policies. Car owners face import taxes (which cover all cars since Singapore does not produce cars), high registration fees, and a purchase quota system in which citizens must bid for the right to buy a car at auction. Once purchased, cars then carry annual road taxes, fuel taxes (with surcharges for leaded fuels), high parking costs and parking scarcity, and finally a comprehensive congestion pricing scheme that charges users for driving into parts of the city based on real-time congestion levels. Despite these policies, car own-

Gantries detect cars entering Singapore's congestion zone and charge drivers automatically (Source: "Electronic Road Pricing" 2007)



The Constellation Plan of 1991 (Source: Cervero 1998)

ership is still rising, though at a slow pace of 3% a year in the late 1990s. [24]

Looking to the future, Singapore will be implementing more policies to get people out of cars and into other forms of transportation. The "Ring Plan" concept of the 1970s which led to the creation of many new towns that still required commuting was replaced with a "Constellation Plan" in 1991 that envisioned new towns as self-sufficient with more employment located within non-motorized distances of residents. With the publication of Singapore's Concept Plan 2001, transport continues to be a key component as the city plans to grow to 5.5 million people by mid-century.[25] The mass transit system continues to expand, including new forms of transport like a light-rail system for shorter trips. The new central business district currently rising out of the waters of Marina bay will be free of cars, catching automobiles at perimeter parking lots. Developers are required to build an elevated moving sidewalk system ("travelator") in much of the district. Heavy spending on landscaping and public spaces will be used to entice people outside despite the harsh tropical weather.[26]

Much of Singapore's success cannot be replicated elsewhere. The strong position of the Singapore government is unique and many jurisdictions do not have the power to implement

The skyline of Singapore's CBD, which will expand onto reclaimed land in Marina Bay (Source: "Marina Bay, Singapore" 2007)

such strong-yet-effective policies. Furthermore, as a city-state, Singapore has the unique advantage of an integrated government structure that combines all national, regional, and local policy decisions. Finally, Singapore began implementing its policies early in its economic development meaning so that it was not saddled with extensive legacy infrastructure developed outside of transit-oriented policies. Nonetheless,

Singapore provides a model for transit-oriented development: a modern city that orchestrates land use and transportation policy in a way that accommodates cars without letting them direct development. [27]

Sha Tin, Hong Kong SAR

Part of Hong Kong's "second generation" of New Towns developed in the New Territories during the 1970s, Sha Tin is now home to approximately 630,000 people.[28] Despite an existing Kowloon Canton Railway (KCR) station, the Sha Tin New Town project, like the other New Town projects of its time, originally envisioned the community as primarily highway-based with automobile connections providing connections to other parts of Hong Kong. Today, Sha Tin is characterized by high-density development associated with a rail station and a major shopping center with a cinema and an amusement park. The shopping center also connects the KCR station to the waterfront Sha Tin Central Park.[29] Commissioned by the KCRC, the Linear City Research project is investigating strategies to use the Sha Tin rail station to connect different communities and land uses.[30]

Munich, Germany

The case of Munich, Germany, highlights a transit system that weaves together a dense, transit-based urban center and low-density, automobile-based suburbs. It is further significant because Germany is country where automobiles are associated with "political freedom, postwar prosperity, and socioeconomic status."[31] While German car ownership is only behind that of Scandinavia and the United States, Munich has been able to attain transit mode splits of 27% of all trips on public transportation, 25% on foot and 46% in private automobiles. (Transit usage is greater in the city's historic core and lower on the periphery.)

A tram in Munich's city center, part of the MVV's multi-modal network (Source: NYCSubway.org 2005)

Cervero also highlights two developments in the Munich metropolitan area that facilitate transit usage. Located just outside the central city on an U-Bahn (urban rail) stop, Arabella Park is home to 10,000 residents and attracts 18,000 daily commuters.[32] Built in phases since the 1960s, it mixes housing, offices, retail, and community facilities within walking distance of the subway station. Restrictions on automobile access and plenty of landscaped pedestrian pathways have contributed to a mode split where 65% of all resident trips to work or school are made on transit and 50% of shopping trips are made by non-motorized means. The second project, constructed by the same developer as Arabella Park, is called Zamila Park, and holds 1,300 units of housing along with community facilities, retail, and office space all within walking distance of an S-Bahn (suburban rail) station. Looking to the future, there are plans to move the nearby station to the center of Zamila Park.

Land-Use and Transit Policy: Resources for Further Study

On the Web

California TOD Database – An

An aerial view of Arabella Park (Source: Kenworthy)

online resource maintained by the State of California with searchable descriptions of transit-oriented projects around the State. www.transitorienteddevelopment.dot.ca.gov

Kowloon-Canton Railway Corporation – The official Web site of the KCRC presents a basic outline of the Corporation's activities, including its transit and property arms. www.kcrc.com

Linear City Research Hong Kong – An ongoing research project engaging academics from various universities and funded by the Kowloon-Canton Railway Corporation (KCRC). The project seeks to provide new strategies for development and urban planning along KCR routes.

www.linearcity.hk

PlanNYC 2030 – The public body responsible for New York Mayor Michael Bloomberg's comprehensive vision for making New York City more sustainable over the next 20 years. The PlanNYC Web site offers digital copies of the plan as well as other resources. www.nyc.gov/2030

Transit Cooperative Research Program – A research group funded by various government transportation agencies in the United States. The Program publishes a variety of detailed reports on transportation and related policies. www.tcrponline.org

In Print

Cervero, Robert. 1998. The Transit Metropolis: A Global Inquiry Washington, DC: Island Press. – A comprehensive study of transit policies from around the world by a leading American transportation scholar.

Dewar, David and Fabio Todeschini. 2004. Rethinking Urban Transport After Modernism: Lessons from South Africa. Hants, UK: Ashgate Publishing Limited. – A fascinating

approach to land-use and transportation policy that combines sociology with technical planning, drawing on the experience of South Africa.

Schrag, Zachary M. 2006. The Great Society Subway: A History of the Washington Metro. Baltimore: The Johns Hopkins University Press. – The story of Washington, DC's Metrorail system and how it was built. It includes chapters on system design, the politics of getting it built, and the varying land-use policies that communities implemented in tandem with its construction.

Notes

[1] Liu 2006

[2] Conover 2006

[3] "Shenzhen Leads" 2002

[4] Shenzhen Planning Bureau 2005; Collier 2005

[5] Shenzhen Planning Bureau 2005

[6] Ibid

[7] Cervero 1998

[8] Ibid

[9] Ibid

[10] Ewing 1999; Dewar and Todeschini 2004

[11] Shenzhen Planning Bureau 2005

[12] Cervero 1998

[13] Cervero 1998

[14] Ibid

[15] Cervero 1998; Chin 1998

[16] Aranda 2006; Ewing 1999 Cervero 1998

[17] KCRC 2006

[18] Cervero et. al. 2004

[19] Ibid

[20] Ewing 1999

[21] Ibid

[22] Na 2006

[23] Aranda 2006; Ewing 1999; Dewar and Todeschini 2004

[24] Cervero 1998

[25] URA 2001

[26] Cervero 1998

[27] Ibid

[28] Information Services Department 2007

[29] Bristow 1989

[30] Linear City Research 2006

[31] Cervero 1998, p. 214

[32] Cervero 1998

References

Aranda, Marlon Patrick. 2006. "Transit-Oriented Development and The Hudson-Bergen Light Rail: Shaping Urban Design Patterns in Northern New Jersey," Department of Urban Studies and Planning, Massachusetts Insti tute of Technology, Cambridge, MA.

BeyondDC. BeyondDC Website. 2006 <http://www.bedyonddc.com> (8 May 2007).

Bristow, Roger. 1989. Hong Kong's New Towns: A selective review. Hong Kong: Oxford University Press.

Cervero, Robert. 1998. The

Transit Metropolis : a global inquiry. Washington, D.C.: Island Press.

Cervero, Robert et. al. 2004. "Transit-oriented development in the United States : experiences, challenges, and prospects." Washington, D.C.: Transportation Research Board of the National Academies.

Conover, Ted. "Capitalist Roaders." New York Times Magazine, 2 July, 2006, 30.

Chin, Hoong Chor. 1998. "Urban transport planning in Singapore." In Planning Singapore: from Plan to Implementation, ed. Belinda Yuen. Singapore: Singapore Institute of Planners.

Collier, Robert. 2005. "The good life means more greenhouse gas." The San Francisco Chronicle, July 6, A1.

Dewar, David and Fabio Todeschini. 2004. Rethinking Urban Transport After Modernism: Lessons from South Africa. Hants, UK: Ashgate Publishing Limited.

"Electronic Road Pricing." Wikipedia. 23 April 2007 <http://en.wikipedia.org/wiki/Electronic_Road_Pricing> (8 May 2007)

Ewing, Reid. 1999. Pedestrian and Transit-Friendly Design: A Primer for Smart Growth. Washington, DC: International City/County Management Association and Smart Growth Network.

Kowloon-Canton Railway Corporation. KCRC Website. 2006 <www.kcrc.com> (2 May 2007).

Han, Hye-Sung. 2000. "Prototypes of Transportation Nodes with High Density and Mixed-use to be Applied to Pearl River Delta Region," Department of Urban Studies and Planning, Massachusetts Institute of Technology, Cambridge, MA.

Information Services Department. 2007. "Hong Kong: The Facts: New Towns and New Major Urban Developments." Hong Kong: Hong Kong Special Administrative Region Government.

Litman, Todd. 2004. "Rail Transit in America: A Comprehensive Evaluation of Benefits." Victoria, BC: Victoria Transport Policy Institute.

Linear City Research Hong Kong. 2005. "Rail Transport & Urban Development in Hong Kong." Hong Kong: Linear City Research.

--. 2006. "CPD Presentation: Rail Transport & Urban Development in Hong Kong." Hong Kong: Linear City Research.

"Marina Bay, Singapore." Wikipedia. 29 April 2007 <http://en.wikipedia.org/wiki/Marina_Bay%2C_Singapore> (8 May 2007)

"Mass Rapid Transit (Singapore)." Wikipedia. 5 May 2007 <http://en.wikipedia.org/wiki/Mass_Rapid_Transit_

%28Singapore%29> (8 May 2007).

Muncher Verkehrs und Tarifverbund (MVV). Munchener Verkehrs- und Tarifverbund Website. <www.mvv-muenchen.de/en> (2 May 2007).

Munich-Info GmbH. Munich-Info Website. 2007 <http://www.munich-info.de> (8 May 2007).

Kenworthy, Jeff. "Urban Villages." Murdoch University Institute for Sustainability and

Technology Policy Website. 2007 <http://www.sustainability.murdoch.edu.au/casestudies/Case_Studies_Asia/urbvill/urbvill.htm > (8 May 2007).

NYCSubway.org. 2005 <http://www.nycsubway.org> (8 May 2007).

PlaNYC. 2007. A Greener, Greater New York. New York: The City of New York.

Project for Public Spaces. "Transit-Friendly Streets." Project for Public Spaces Website. 2006 <http://www.pps.org/info/placemakingtools/casesforplaces/transit_friendly_sts> (8 May 2007).

Reform. "Potential Impact on the UK: Road Pricing: Reduces Congestion and Improves Investment." Reform Website. <www.reform.co.uk/website/transport/roadpricing/potentialimpactontheuk.aspx> (8 May 2007).

"Shenzhen Leads Nation in Car Penetration." 2002. People's Daily, August 2.

"Shenzhen Comprehensive Transportation Plan." 2005. Shenzhen: Shenzhen Planning Bureau.

Schrag, Zachary M. 2006. The Great Society Subway: A History of the Washington

Metro. Baltimore: The Johns Hopkins University Press.

Sun, Na. 2006. "Rethinking Walled Residential Compound in Peripheral Urban China: A Guideline for Boundary and Size Design," Department of Architecture, Massachusetts Institute of Technology, Cambridge, MA.

Urban Redevelopment Authority (Singapore). "Concept Plan 2001." URA Online. <http://www.ura.gov.sg/conceptplan2001/index.html> (8 May 2007).

"Work starts on three major roads." News Guangdong. 12 February 2007 http://www.newsgd.com/citiesandtowns/shenzhen/news/200702120042.htm> (2 May 2007).

World Bank. 2002 Cities on the Move: A World Bank Urban Transport Strategy Review. Washington, DC: World Bank.

BUILDING COMMUNITY FACILITIES

Astrid Wood

Community Facilities Build Community

Community facilities build communities by creating a equitable space that provides a variety of amenities for a variety of users. These spaces remove the barriers that may prevent community development. Civic centers are important gathering spaces and can serve an endless variety of functions. Good community facilities incorporate a variety of uses to be timelessly attractive.

Building community facilities can be complicated. For-profit developers are not usually interested in creating community facilities, which are often not profitable. Likewise, while government may be interested in building such spaces, it typically lacks the funds to build facilities without private funding. Meanwhile, individuals living without community are not politically empowered to demand a better built environment. Even if all stakeholders come together, it is difficult to design a truly equitable space.

Given the difficulty of building community space, how can Shenzhen's government, developers and community come together to create equitable space for the people? Will new community spaces provide areas of Shenzhen with a distinct identity? Can community spaces generate enough revenue to supplement their cost? Can these facilities be viable in less trafficked areas? What is the appropriate balance of retail, green space, and circulation space?

The purpose of this section is to understand what tools can be used to create dynamic community facilities. These cases are not prescriptions for Shenzhen, but rather they serve to highlight instances when a combination of tools has achieved the goals.

Scenario

The population of the district has shifted. It is a wealthier community with more leisure time and a growing interest in culture. The needs of the day and night populations have changed. They need more restaurants, retail, museums, libraries, plazas, and open space. These facilities can serve locals and visitors. Enhanced community spaces can provide the Bantian district with a marketable identity that can be sold along with real estate.

The development of a new metro line in the area makes this the opportune time to build new community facilities. Improved access will make the area viable. New facilities must be located within 400 meters of the metro stop. The metro will bring new people to the area and the amount and types of facilities planned will serve a day population of 200,000.

What tools can be used to build community facilities?

* Market the void of community facilities. Telling locals about the importance of community facilities will create a demand for them.

* Provide financial incentives to attract private developers. The government can offer affordable loans to developers or offer linkage opportunities. Offering developers reasons to build community facilities will achieve the desired outcome.

* Institute a regulation system. Tax increment financing is a useful tool to leverage public spending to pay for community facilities. A new restaurant tax, for example, can help pay for a new plaza in Bantian.

* Good design will spark the construction of new buildings. Clustering government facilities around a central area will make the area attractive to other developers to build new and additional community spaces.

What are the goals of these tools?

Community facilities have limitless potential. They can effectively:

* Build Communities. Community spaces promote social values and neighborly interactions among residents. These tools are motivated by a need to build connections in the Bantian district.

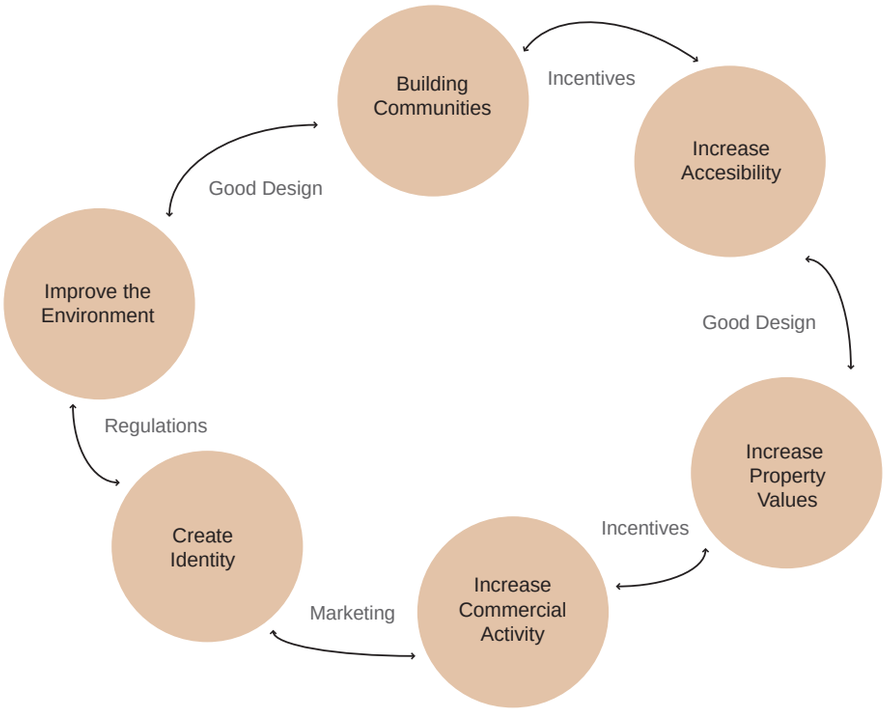
* Increase Accessibility. Improved community spaces open up areas and remove physical and social barriers to a place. Community spaces are plural and invite all individuals.

* Increase Property Values. A new civic center will generate substantial investment in and around the district. This strategy provides an incentive for property owners to support the development of community spaces.

* Increase Commercial Activity. With more people visiting, shopping, eating, and working, community spaces will bring people onto the streets.

* Improve the Environment. Improve the local environment by adding green space. Additional greenery will provide porous surfaces and increase environmental awareness.

* Create an Identity. Lively community facilities will transform the district into a lively and distinctive area of Shenzhen and will provide Shenzhen with an identity. Placemaking is a critical purpose of community spaces. Community facilities



This diagram illustrates the ways to use each of these tools

will enrich the area and improve the quality of life for residents.

On what scale does each tool apply?

This tool is applied on the district level. Community facilities cannot be built independently of each other and together form a unified district.

Who will use each tool (e.g. developers, government, residents)?

The construction of community facilities must be driven by the government, in conjunction with market forces.

Property owners often avoid building community spaces since they are not inherently profitable. But if the developed area can be enhanced by these facilities, then the addition of more community facilities will be more profitable and future projects will be attractive to the private sector.

The public is also responsible for building community facilities. They must demand these spaces to invite developers and government to build them and they need to use the new spaces to guarantee their maintenance.

How do you measure the success of the tools?

The success of the tools can be measured if:

* Street activity increases
* Investment in the neighborhood increases
* Visitors to the area increase
* New businesses open in the developed spaces
* Property values increase
* The area becomes a destination

What is required to make this tool work?

* Government regulations and incentives
* Private support
* Effective planning
* Community participation
* Innovative designs and uses

What are the best practices for this combination of tools?

Careful research has revealed case studies that illustrate an appropriate combination of the tools. Of the many successful illustrations of these tools, three examples were selected: Silver Spring, Maryland, Providence, Rhode Island, and the National Mall in Washington D.C. Each of these spaces has used public-private partnerships to create great indoor and outdoor community spaces.

Silver Spring, Maryland, USA

The redevelopment of downtown Silver Spring demonstrates the possibilities for the regeneration of Bantian as a regional subcenter composed of civic, cultural, commercial, and entertainment amenities. Using a balanced combination of public incentives, private investment, and good design, this area is a success.

The design tool was instrumental in creating Silver Spring's community spaces. The variety of facilities in this "first ring" suburban downtown keeps the area active. New developments include more than one million square feet of retail space, movie theatres, restaurants, and grocery

stores. World headquarters of national organizations, affordable housing units, and civic spaces share ground space. These buildings are surrounded by civic amenities and public art.

The plan has increased the site's accessibility. Situated along a metro stop, the design of Silver Spring created a transit-oriented community. The red line train stops at Silver Spring and connects to the metro-bus and ride-on bus. Several extensive public parking structures make this destination incredibly accessible.

Images of Downtown Silver Spring. Source: Rudy Bruner Awards, 2005.

Much of the project's success can be attributed to the establishment of a public-private partnership between business owners in the CBD and Maryland's Smart Growth policies. The project used incentive zoning to provide significant opportunities for public involvement.

The new downtown is connected to a series of linear parks nearby. Bike trails connects this downtown to Sligo Creek Park and Rock Creek Park via a series of bike trails nearby. Cyclists and walkers can enjoy the civic space without driving downtown.

Silver Spring is appealing to both locals and visitors, offering first time visitors innovative experiences and providing plentiful activities for locals. This once blighted area has been reborn as an attractive and efficient space. The image of Silver Spring has been dramatically altered by the success of this project.

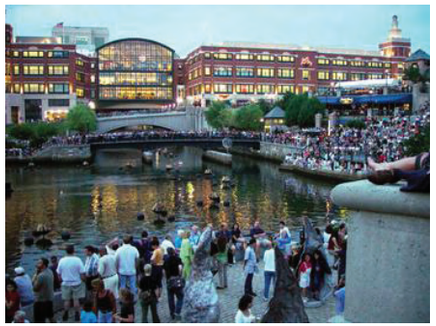
Providence, Rhode Island, USA

Providence combined public and private funds to build community facilities and redevelop an abandoned downtown. Good design emphasizing pedestrian connections was at the heart of the plan. As a result of this redevelopment, property values have surged.

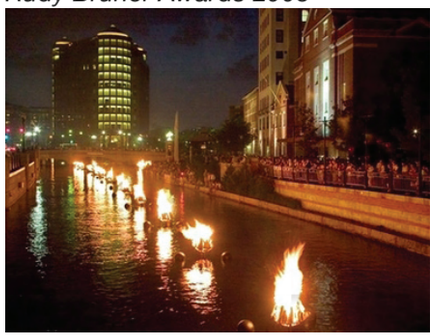
The projecte uncovered the city's downtown canal and turned it into a viable open space. New pedestrian pathways link the river with indoor and outdoor community spaces. Improved mass transportation and the realignment of the highway have improved connections between the downtown and surrounding areas. The project uses its impressive public arts program to bring people back downtown and increase property values.

This project is a blending of three separate sequential construction programs and reflects a flexible planning process. Financial incentives were used to draw private interest and the success of the project can be attributed to the complex collaboration of various large-scale, multi-agency, public-private projects. Funds from the National Endowment for the Arts, the Governor's office, the Rhode Island Historical Preservation Commission, The Rhode Island Department of Transportation, the City of Province, and the Federal Highways Trust Fund were leveraged for the project.

The project is focused around developing community spaces through public art projects. A key project,



The Providence Canal has been uncovered and transformed into a 24-hour center for cultural, commercial, and outdoor community development. Source: Rudy Bruner Awards 2003



"Waterfire" has been widely successful, drawing interest from the local community and across the nation. Creator Barnaby Evans strategically places more than thirty fires along the river. This unique event draws people downtown and generates economic revenue for the city. Public events such as these have also been strong marketing campaigns, gaining additional support for continued funding of downtown community spaces.

The redevelopment of downtown Providence was achieved by using the tools described earlier. Collaboration between public and private agencies was particularly important. Good design and effective marketing were achieved by using the community facilities as a means of building community through space. Continued investment downtown is a measureable success of the project. The project generated a sea of changes with ripple effects spreading outward from downtown.

The National Mall, Washington, D.C.

The National Mall is a cultural center where heritage, open space, and transportation converge. It is the large green space stretching from the Washington Monument to the United States Capital, in the center of many Smithsonian museums, national monuments, and memorials. The Mall is one of the best clusterings of community spaces in the U.S.

While the mall was conceived by Pierre L'Enfant in his 1791 plans for the city, it was not realized until the early part of the 20th century under the McMillan Commission plan. The McMillan plan was the tool with which the government initiated the development of this community space. This plan exhibited the desire to develop the space between the White House and the

Cultural, civic, and outdoor facilities are mixed together to create a universally attractive community space. Source: www.visitingdc.com/images/national-mall-map.jpg

Capital as a community space.

As a result of this government programming, more than 17 national museums surround the National Mall, including the National Museum of American History, the National Museum of Natural History, the National Gallery of Art, the National Art and Space Museum, and the National Museum of the American Indian. The unity of these cultural attractions makes the Mall one of the most popular tourist attractions in the United States.

Its design is at the heart of its popularity. The Mall is a site for public gatherings and celebrations amd its open expanse makes it an ideal location for festivals. The annual Smithsonian Folklife Festival exhibits cultural heritage from all parts of the globe. The Mall also hosts the nation's annual Independence Day fireworks and several film and music festival. Individuals enjoy exercising and relaxing in the park as well.

The Mall's success can also be attributed to its location in the heart of so much cultural activity. The Mall is highly accessible by automobile, subway, and bus.

While the National Mall is incredibly successful as a cultural destination, its retail and commercial opportunities are limited. More balanced community spaces that include commercial facilities are recommended for Shenzhen.

This space has made downtown Washington D.C. vibrant and provided the city with substantive revenue. The Mall is particularly impressive for the intergovernmental collaboration needed to ensure its viability.

How has Shenzhen worked to redesign its cultural spaces?

Shenzhen's new community space should learn from the following cases the best ways to build community.

In 1996, Shenzhen proposed a number of culture and entertainment facilities. The city sponsored a series of design competitions to bring internationally-renowned architecture to Shenzhen. New projects include the city's Museum, Exhibition Hall, Central Library, Cultural Center, Opera House, Concert Hall, and Modern Art Museum. As a result of these efforts, Shenzhen built the new City Hall with a distinct curved roofline which will provide the CBD and the city with a new identity. Arata Isozaki's winning design for the Shenzhen Cultural Center will build community around the concert hall and library. The city also pushed

Sources

Shibley, Robert, Emily Axelrod, Richard Wener, and Jay Farbstein. Creative Community Building: 2003 Rudy Bruner Awards for Urban Excellence. Cambridge: Bruner Foundation, Inc., 2003.

Shibley, Robert, Emily Axelrod, Richard Wener, and Jay Farbstein. Reinventing Downtown: 2005 Rudy Bruner Awards for Urban Excellence. Cambridge: Bruner Foundation, Inc., 2005.

Washington DC and Tourism and Visitors Bureau. "Visiting D.C." 2006. www.visitingdc.com/images/national-mall-map.jpg.

URBAN VILLAGE REGENERATION

Kumar Kintala

Introduction

After 20 years of Shenzhen's rapid growth, people that lived in Shenzhen prior to the post-1979 wave of urbanization, or villagers, remain an integral part of the city. Collective development of village land has yielded urban villages that are dense and vibrant, but unsafe. The villages are considered Shenzhen's gateways, housing unregistered migrants from throughout China. As growth continues the regeneration of villages can play a vital role in sustainable planning and housing. The challenge is to retain the villages as a gateway to the Shenzhen dream while better serving residents and the whole city.

What are Urban Villages?

The development of Shenzhen's urban villages accompanied the city's modernization and rapid growth. The following diagram portrays the pattern of change:

Freestanding agricultural land.

Urbanization circa 1979 and infrastructure planning.

↓

Development approaches the farmland.

Authorities negotiate and purchase the land.

Villagers retain 10% of land for collective development.

↓

Rapid growth, high-rises and industry surround villages,

Villagers expand homes, filling lots to FAR 4,

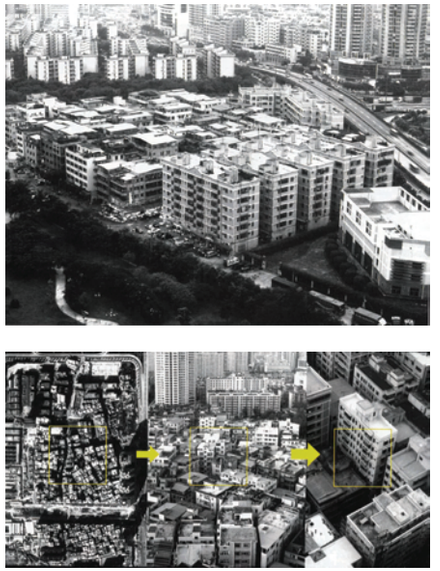
Rentals to migrant population,

↓

Continued market pressure for housing,

Continued infrastructure implementation,

Concerns about overcrowding, crime, and ghettoization,



Above are images and perspectives of urban villages in Shenzhen. The typical lot size is 10 x 10 meters, and buildings have expanded in all directions within those lot configurations. source: Urbanus, "Village/City"

What are the goals of regeneration?

Several goals are critical to the future of equitable and successful development throughout Shenzhen, and will frame the process of regeneration.

* Provision of affordable housing and services – Villages currently provide low-cost housing to migrants. While continuing to perform that function, they should better accommodate the needs of residents, including safety, quality of life, health, education, and community services.

* Participation in economic growth – Considered the wealthiest city in China, Shenzhen is expected to continue to grow rapidly. Village residents should partake in the growth through the introduction of small businesses, light manufacturing, and cultural development.

* Connections to district network – Individual villages are located within larger areas that are experiencing dramatic population and economic shifts. The villages should be part of a district-wide network that connects people with different incomes and that integrates civic and retail facilities.

* Maximize property value – The village owners should be able to reap financial gains from redevelopment within the constraints of the other goals for regeneration.

* Accessibility – Shenzhen has become a city of cars for the growing population that can afford them. Residents should be able to access various opportunities (i.e. jobs, education, friends, services) via a variety of transportation modes.

What are the tools?

Three categories of tools are necessary for sustainable village regeneration: process tools, physical tools, and policy tools.

Actors

The sustained involvement of many different actors is necessary for the many different tools of village regeneration:

* Villagers – resident and non-resident owners

* Government – planners and political officials

* Current residents – renters, floating population, middle income, singles, and families

* Development industry– real estate developers and financiers

Serious negotiations between the villagers and the government are essential for successful implementation of village regeneration. The interests of the public and the government must be balanced with those of existing residents and owners. The negotiations should include on-site meetings, internet-based conversations, and sketch-based physical planning. This challenging task is critical to meeting the above goals equitably.

What are the tools?

Process Tools

The models for regeneration are shaped by three variables: the scale of assembly, the type of government

Scale/ Assembly	*Government Intervention*	*Village Incorporation*
Parcel by parcel *Full assemblage*	*Incentives* *Regulations* *Exactions* *Infrastructural* *Ownership* *Operation*	*Independence* *Cooperative development*

Combining elements from these three categories yields several models of the regeneration process.

* Private parcel-by-parcel rehabilitation – The villagers continue existing patterns of developing parcels individually. The government or the community may establish standards for redevelopment.

* Private assembly and redevelopment – The villagers combine their holdings and redevelop it collectively. The government or the community may establish standards for redevelopment.

* Government scattered-site development –The government selectively acquires specific lands from the villagers. Using these lands, the government could create infrastructure like streets, public spaces, and schools, or it could build public housing.

* Government assembly and redevelopment – The government acquires the land from the villagers in order to assemble and

Process Tools

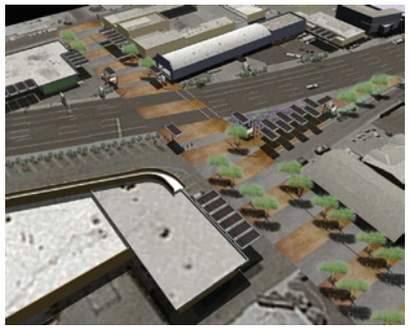
Architect Fumihiko Maki's framework for understanding built form is helpful in developing a set of physical tools for village regeneration. In the group form approach, he suggests a way of addressing "collective form" (building and space together) that can guide the redevelopment of urban villages.

This diagram portrays the group form approach to collective form, which is valuable for village regeneration. source: Maki & Associates

The group form approach includes several components: (1) consistent patterns but spots of variety in materials and public spaces, (2) wise use of geography and topography, (3) human scale, (4) sequential development among all land uses through time, and (5) regional expression.[2]

Applying group form principles to village regeneration yields several tools that can increase the quality of life in existing urban villages.

* Streetscape improvement – Improving public spaces, retail frontage, signage, lighting, pedestrian pathways, and branding can enhance retail corridors and connections between neighborhoods. In Phoenix, the Melrose on 7th project coordinated the installation of bus stops



and public art with lighting, new crosswalks, and landscape elements.[3]

* New public streets – New streets facilitate movement from villages to activities elsewhere in the district and can be used to organize the built form. They should at a human-scale and accommodate all modes of transportation.

* Civic facilities – New civic facilities such as community centers, libraries, job training, or health clinics should be accessible for

This image illustrates the use of new public spaces to create connections between existing neighborhoods.

This apartheid museum is located between neighborhoods in order to serve as a public gathering space. source: Noerro Wolff architects

* Public/open spaces – Public and open spaces increase the quality of life by addressing the human-scale and environmental needs (such as stormwater retention). A variety of park types should serve village residents and a broader community, hosting a variety of passive and active elements.

This 409 square meter neighborhood park in Cambridge, MA, provides a beautiful resting space for passers-by and residents. source: City of Cambridge

* Preservation and adaptive reuse – Preservation and adaptive reuse can be applied selectively in the urban villages once the community indicates which buildings ought to be preserved. The Hong Kong Urban Renewal Authority includes preservation in its core mission; its project on 60-66 Johnson Road in Wan Chai integrated a dilapidated building with additional housing. This model can be applied to urban villages, converting warehouses into senior centers or light industrial establishments into parking garages.[7]

Rendering of the 60-66 Johnson Road project in Hong Kong. source: Hong Kong Urban Renewal Authority

The implementation of such physical tools is contingent on the existing context, including the relationship of the village to its neighbors and the arrangement of facilities within the village. The needs of the community—voiced through a participatory process—will inform the appropriate level of physical intervention.

Policy Tools

Beyond facilitating the specific physical interventions described above, general government policy can encourage village regeneration.

* Building code enforcement – Existing regulations for urban village housing are often ignored by landlords.[1] The Los Angeles Housing Department enforces its multifamily building code effectively, increasing the quality of affordable housing. LA's program provides an outlet for renter complaints, uses numerous well-trained inspectors, and requires inspection every five years, yielding better quality housing for residents.[8]

* Affordable housing provision – Policies that encourage the provision of additional affordable housing would remove pressure from the urban villages as providers of affordable housing and ensure continued affordability when villages are redeveloped. Affordable housing is explored more fully in other sections of this volume.

* Zoning/land use policy – Land use regulation can protect residents from undesired uses. Well-crafted regulations can shape the built form and programming of redeveloped urban villages to encourage a high quality of life.

* Transfer of development rights (TDR) – In areas where there are restrictions on allowable building heights, property owners can sell the development rights of their undeveloped building area for use on another property. For example, the City of Seattle has a TDR program which allows owners of historic properties and affordable housing to sell their development rights for use in other areas.[9] In Shenzhen, village owners could sell development rights to be used around transit stations.

These policies illustrate the potential to achieve village regeneration on a human scale, while meeting the villagers' fiscal interests and achieving citywide goals. Despite the breadth of tools presented here—model processes, physical changes and policies—serious negotiation between the village residents and the government is necessary in order to yield successful and equitable results.

How to measure the success of urban regeneration?

A full measure of the success of urban regeneration must encompass changes in the quality of life for existing and future residents. The tools described here should be scrutinized for their impact on the creation of a coherent community. Hong Kong performs social impact assessments before and after redevelopment projects via survey techniques; it pays particular attention to the elderly, the disadvantaged and single parents.[7] Individual surveys can measure levels of satisfaction with unit conditions, community conditions, improved mobility, and access to services. Ultimately, measures should account for the long-run goals of village regeneration, including district economic growth, housing affordability, and accessibility of opportunities.

Case studies

Several case studies illustrate urban regeneration outside of Shenzhen. The following three case studies demonstrate the ways in which some of the tools mentioned above, including process, policy, and physical interventions, have been implemented, outside of Shenzhen

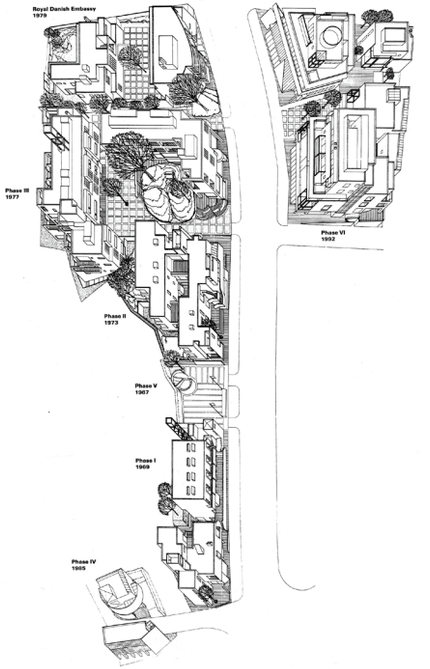
Hillside Terrace Complex – Shibuya, Tokyo

Beginning in the 1960s, the Asakura family sought to develop residential housing estates they owned in a non-central area of Tokyo. The land lied along a busy street that integrated many districts and had street-level retail. The Maki & Associates master plan was implemented in six phases, from 1969 to 1992. Limited process was necessary because of the complete ownership by the family and because there were few existing residents.

However, special zoning variances were necessary to allow non-residential uses and densities greater than an FAR of 1.5. The design has been acclaimed for its ability to "lend character to a major urban artery" and make the "sidewalk a place of activity." The new development includes a series of human-scale courtyards and pedestrian links that draw people to shops and places of reflection. These design elements are appropriate models for village regeneration in Shenzhen.[2 and 9]

Birds-eye view of Hillside Terrace that shows the integration with the rest of the neighborhood and the preservation of green space.

These images highlight the evolution of place to accommodate new uses and to adapt buildings to encourage street life. source: Maki & Associates



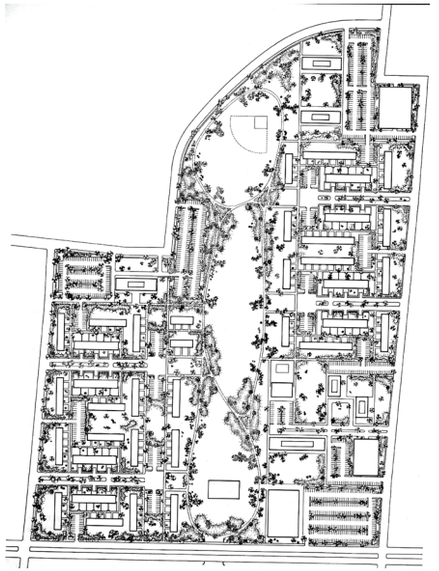
The diagram illustrates the six building phases from the 1969 to 1992, emphasizing the public spaces as links to the main roads and as internal gathering places. source: Maki & Associates

Lafayette Park, Detroit, Michigan

The experience of urban renewal in Michigan demonstrates negative outcomes that can arise from village regeneration—while achieving some of the goals—if the existing community is not engaged in a serious negotiation process.

Between 1950 and 1954, the dense 129-acre, working class acres known as "Black Bottom" in Detroit was razed for the development of a modernist development of towers and low-rise condominiums. The federal government provided US$4.6 million for assembly and clearance, in addition to a loan of US$3 million backed by the Federal Housing Authority. At first, the project was filled with middle income renters. During periods of economic distress in the late 1980s and 1990s, a set of the apartments were designated for Section 8 vouchers. Due to this subsidy program, the development has developed a greater mix of incomes and racial groups than the Detroit metropolitan area. The communal spaces include a pool, party halls, furnished lobbies, and several recreational areas. The process underlying the development of Lafayette Park was very flawed and inequitable as Black Bottom residents were ignored in the process and then relocated to housing projects. The outcome, although respectable, shows the ability of integrated housing in a more unusual, non urban physical form. The form itself is likely not a model for Shenzhen due to its extreme reliance on automobile usage, but its value placed upon communal spaces and range of unit types is admirable.[11]

This diagram shows the previous black bottom neighborhood in red, with the new construction in black, a complete bulldozing of neighborhoods. source: Waldheim, Lafayette Park Detroit



This site plan shows housing blocks, parks, and parking, revealing the focus on communal spaces. source: Waldheim, Lafayette Park, Detroit

Hong Kong Urban Renewal Authority[7]

This case demonstrates a holistic approach to redevelopment within a city of rapid growth, dense housing conditions, and growing democracy.

* Community approach – District Advisory Committees consist of a range of members that provide advice about new projects. Social impact assessments methodically identify people affected by redevelopment projects in order to mitigate negative effects of redevelopment.

* Relocation – Hong Kong combines ambitious clearance and development projects with a rigorous resettlement program. The program provides subsidized down payments, relocation services, loan services, and counseling.

* Tools – The authority implements full-scale clearance and redevelopment, rehabilitation of existing buildings, adaptive reuse of historic sites, and revitalization through provision of public buildings like markets and pedestrian infrastructure.

The renderings for the redevelopment show a new plaza-like environment and building frontages. The project includes 880 units, 120,000 square feet of retail, and 16,000 square feet of open space. source: Hong Kong Urban Renewal Authority

References

1 Urbanus Architecture. Village/City. 2006. http://www.cepp.com.cn.

2 Maki & Associates. Fumihiko Maki: Buildings and Projects. Princeton Architectural Press. New York, NY. 1997

3 Petrucci, Darren, Stripscape design. http://www.asu.edu/cdp/dtn/stripscape/7thAveValleyForward.pdf

4 Dewar, David and Todeschini, Fabio. Rethinking Urban Transport after Modernism: Lessons from South Africa. Ashgate Publishing. Burlington, VT. 2004.

5 Noero Wolff Architects. http://www.noerowolff.com/

6 City of Cambridge. http://www.ci.cambridge.ma.us/CDD/cp/parks/franklin/index.html.

7 Hong Kong Urban Renewal Authority. http://www.ura.org.hk/html/c100000e1e.html.

8 Harvard University Government Innovators Network. http://www.innovations.harvard.edu/awards.html?id=7497 LAHD.

9 Commonwealth of Massachusetts. http://www.mass.gov/envir/smart_growth_toolkit/pages/CS-tdr-seattle.html.

10 International Herald Tribune. http://www.iht.com/articles/1999/01/09/maki.t.php

11 Waldheim, Charles. Lafayette Park Detroit. Prestel Verlag. New York, NY. 2004.

MIXED-USE DEVELOPMENT

Benjamin Solomon-Schwartz

Background

Vanke's Wonderland development currently employs minimal mixing of uses to further goals of the developer, the residents, and the municipality. The development includes ground-floor retail in two sections of the development. While both segments are nominally open to the public, one of them requires passing through a controlled gate to attain access. In that area, the rules explicitly forbid non-residents from lingering in the open space adjacent to the retail. The retail experience is aimed at those that live within the gates rather than those visiting from outside of them, which reduces the efficiency of these facilities. Beyond retail, the development does not share other public facilities with adjoining areas. The Wonderland experience, therefore, is just a beginning. This tool demonstrates how to extend the existing level of mixing to create value for the developer, the residents, and the surrounding communities.

Defining 'Mixing'

Contemporary urban planning wisdom indicates that mixing uses within a development can create *vibrant* places that serve a *broad range* of the members of society. Mixing can occur both within a development and within an individual building. To demonstrate ways to implement such a mix of uses, this tool presents two case studies of successful mixed-use projects. The first case presents a high-end mixed-use development in Boston, Massachusetts – Millennium Place. The second case study presents a market-rate but middle-end development in Arlington, VA – Market Common.

Goals

* To bring amenities close to people's homes;
* To create walkable places through compact development;
* To enable greater interaction between different residential populations;
* To allow existing residents to benefit from new development; and
* To provide greater financial benefit to the developer.

Scenarios and Assumptions

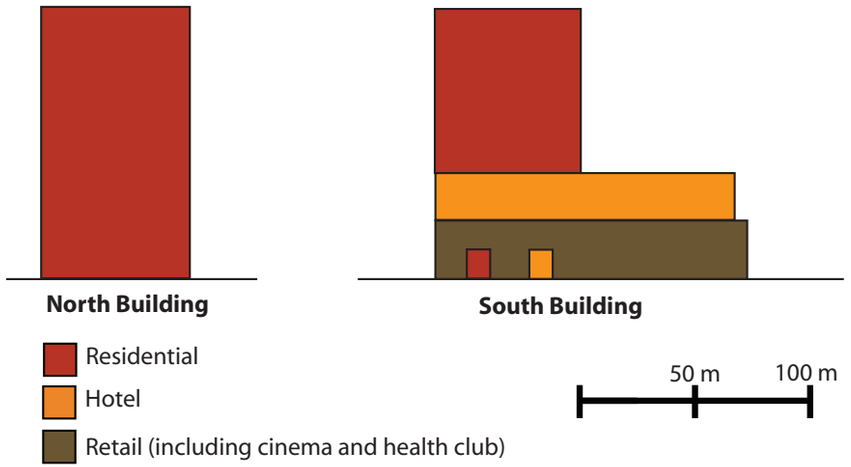
The use of mixing will be more widespread and more successful as income inequalities decrease in China and Vanke's clients desire fewer barriers between themselves and the rest of society. Yet this tool presents a way to increase mixing while acknowledging some existing social divides. For example, the Millennium Place development creates a high-end development not accessible to most people and then invites the general public into a significant part of the development.

Best Practices

The following two case studies—Millennium Place and Market Common—show different ways to mix uses successfully.

Millennium Place Boston, Massachusetts (United States)

* Two 40-story buildings
* Located in Downtown Boston
* Adjacent to Boston Common, Chinatown, and the Theater District



* Easy access to three subway lines

* Separate entrances for different uses

The Components

* 367 condominiums

* 193 hotel rooms

* 35,000 SF Retail (two restaurants and a furniture store)

* 100,000 SF Sports Club

* Loews Theaters - 19 movie screens

* 1,100 below-ground parking spaces

* Nursery School and indoor play area

A view of Millennium Place from Boston Common, directly facing the 19-screen cinema. Photo by Benjamin Solomon-Schwartz.

Most of the elements of this development are targeted at a luxury clientele, including the condominiums, the four-star hotel, and much of the retail. However, the 19-screen movie theater targets a much broader audience – that of mainstream cinema. The cinema also prominently faces Boston Common, the most public of all

of the sides of the development.

The proximity of multiple uses with multiple target audiences increases the likelihood that Millennium residents and people from other walks of life will interact – or at least inhabit some of the same spaces. The fact that a broad audience is targeted for the retail enables the developer to provide significantly more on-site retail than could be supported by the residential and hotel development alone. The sports club thrives by attracting non-resident members, providing the residents with a higher level of service than otherwise possible. Similarly, a 19-screen theater can only exist when it attracts people from beyond the immediate neighborhood, functioning as a regional attraction.

Market Common, Arlington, Virginia (United States)

Arlington, Virginia, is an inner-ring suburb of Washington, D.C., traversed by urban heavy rail corridors of the Washington Metro. It includes zones of considerable density along the transit corridors. By accommodating a mix of uses, the Market Common project significantly increased density within close proximity of a Metro station.

The Intervention:

* 4 hectares
* 87 townhouses
* 300 rental apartments
* 20,067 m2 of retail
* 9,415 m2 of office space (located above the retail)

A view of the Market Common development at night, showing apartments located above the retail establishments. Source: Adrienne Schmitz, Creating Walkable Places. Washington, DC: Urban Land Institute, 2006.

* 0.4 hectare public park and a small central open space area with seating and play equipment for children
* 1,368 parking spaces in a structure that is integrated into the office and residential building, in addition to spaces dedicated to project residents

By providing a variety of retail options in close proximity to the residential

Townhouses are located on the periphery of the project, creating a transition from the center of commercial activity to the adjacent neighborhood. Source: Adrienne Schmitz, Creating Walkable Places. Washington, DC: Urban Land Institute, 2006.

units, this project brings together residents and shoppers in a single experience. The project includes restaurants and a variety of specialty stores selling clothing, electronics, housewares, and books. The retail serves local residents and workers at nearby offices, and it also offers a shopping and eating destination for people from a larger area of the city. Unlike the Millennium project discussed above, there is no notable distinction between the audiences for different segments of this mixed-use project. Both the residential and retail segments are targeted towards a middle class clientele.

Like Millennium, this project takes advantage of close proximity to public transportation and to existing amenities, but it also sets itself apart from those existing developments. Both provide significant on-site parking to provide easy access for patrons using all forms of transportation. Despite the fact that the project consists of a single four-hectare block, it is permeable to pedestrians—including area residents—who are able to walk between elements of the project to reach the commercial center within it and to pass through to other areas of the neighborhood.

Where Do They Mix?

A mix of uses can occur within a building, a site or a district. In both of the case studies presented here, mixing occurs both within sites and within individual buildings. In these two projects, residential and retail uses are combined to benefit all of the users of the project. In Millennium Place, the mixing occurs within a single building complex. Hotel and retail uses complement the residential units. In the Market Common, the mix of uses occurs within a series of interconnected buildings. Because the Millennium Place is in a more urban setting than the Market Common, mixing in the former is vertical whereas mixing in the latter is primarily horizontal. Regardless, in both projects separate entrances are provided for the different uses.

These tools can be pursued by developers and by municipal officials. The Millennium Place project was championed by the developer, with significant cooperation from the City of Boston. The Arlington project involved the creation of a master plan for development in the area by the local government, the involvement of a persistent developer, and numerous meetings among the developer, community groups, and government officials. Together they developed a project that was profitable to the developer—which sold it at a profit soon after the project was completed—and beneficial to the surrounding community. Whether championed by a developer or by government officials, mixed-use development can bring about many of the successes described here.

Evaluating Mixing

Ultimately, it is important to evaluate the work of this complex tool. Several criteria should be used in order to determine whether it has been used successfully:

* Does it bring value to the property being developed? Does it bring values to adjacent properties?

* Does it serve more segments of the population than a non-mixed development?

* Does it improve the perception of area residents towards the development?

* Does it help integrate a development with the surrounding urban context?

Sources

Millennium Place

Susan Diesenhouse, "Reviving Boston's Languishing Mid-Town District," *The New York Times,* August 24, 1997.

Millennium Place (Boston, Massachusetts), ULI Award for Excellence, Finalist, 2003, www.uli.org.

http://www.emporis.com/en/wm/bu/?id=millenniumplacetower1-boston-ma-usa

Market Common

http://www.mccafferyinterests.com/content/current/mcc.htm

http://www.planningcenter.com/resources/documents/TNS_CaseStudy02_MarketCommon.pdf

http://www.greenbiz.com/sites/greenerbuildings/case_studies_detail.cfm?LinkAdvID=66100

MIXED-INCOME HOUSING

Amy Stitely

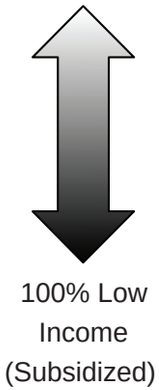
What is this Tool?

Mixed-income housing development is a broad term that carries different meanings for different audiences. The simplest definition is that which the name implies – housing residents with a mix of income levels within one development.

Mixed-Income Housing developments vary along the following measures:

* The scale and degree of income mixing
* The tenure type – rental, ownership, or cooperative
* Population served – family size, age, race, employment status
* The amount of spatial integration across income levels

Regardless of these variables, the Mixed-income strategy has emerged as the preferred model for developing affordable housing in the United States. National policy makers began directly promoting Mixed-income developments in the mid 1980s through a variety of programs and legislation. State and local policy makers followed suit, enacting local zoning and planning regulations to encourage this type of development.[1]



Category	Description	Unit - Income Mix	
		% Units	% of AMI*
Moderate-Income Inclusion	Predominately market-rate units with 20% for moderate-income households	80%	Market
		20%	80%
Low-Income Inclusion	Predominately market-rate units with 20% for moderate-income households	80%	Market
		20%	50%
Broad Range of Incomes	Serves market-rate, moderate/low-income, and extremely low-income households equivocally	33%	Market
		33%	60%
		33%	30%
Market-Inclusion	Serves predominately low-income households with 20% market-rate units	20%	Market
		80%	50%
Affordable Mix	Serves moderate/low-income and extremely low-income households	50%	60%
		50%	30%

Table 1 - Five Classifications of Mixed Income Housing (Source: Smith 2002)

*AMI – Area Median Income

The range of Mixed-income developments can be classified on a scale of being closer or further away from a true real estate market. Along this scale, there are five major classifications of Mixed-income

projects as shown in Table 1 above.

Note that this table only addresses mixes for residents living at or above the poverty line (30% of area median income, or AMI). However, a recent study shows that households living below the poverty line can also be effectively integrated into middle-income neighborhoods. As long as these households occupy no more than 15% of the total units, no negative economic or social impacts affect the surrounding community.[2]

What is the goal of using this tool?

Cities operating under the free-market economy tend to spatially and socially subdivide by class, thus creating zones of wealth and zones of poverty. Those living in neighborhoods with high concentrations of poverty (over 40%) are shown to be adversely affected by:

* Poorer health
* Lower levels of academic achievement and school performance
* Fewer employment opportunities
* High exposure to violence & crime[3]

These adverse effects are linked to:

* The absence of positive role models – 'social isolation'
* Restricted access to services
* Social stigmatization

Furthermore, children that grow up in neighborhoods with high concentrations of poverty often remain in the same marginalized life situation as adults. Poverty is persistently cyclical, thus passed down from generation to generation.

Mixed-income housing aims at de-concentrating poverty and promoting economic diversity within neighborhoods with the intention of:

* Reducing the proliferation of "negative behavior," like violence and crime.
* Offering more "life chances" by fostering social interaction across classes. Higher income residents may serve as role models and provide social networks to increase employment opportunities for lower income residents.
* Transforming distressed communities into healthy communities.

Mixed-income redevelopment of a formerly impoverished neighborhood can stem the cycle of disinvestment, opening the door for a more equitable distribution of public goods like schools and healthcare.

On what scale does this tool apply?

Mixed-income housing is usually applied at the district, site or the building level. There are an infinite number of methods for distributing affordable units across a project area. They occur along the spectrum between these two extremes:

* Highly concentrated: Designating an entire building or cluster of buildings as "affordable" within a medium or large scale site.

* Highly dispersed: Evenly distributing "affordable" units within all buildings on a site.

Hong Kong public housing estate: highly concentrated distribution of low-income units (Source: Peter Benz)

Chicago Hope VI redevelopment: highly dispersed distribution of low-income units (Source: Payton Chung)

The highly concentrated model has worked well at the district level in the New Towns of Singapore and Hong Kong, but it has been less successful in some cases in the United States. American policies at the state and national levels currently favor the highly dispersed method.

There are five major classifications of income mixes. They occur on a continuum of less aggressive to more aggressive mixes, as projects range from 100% market-rate to 100% low-income. To determine which of these five income mixes is most appropriate for a site, a developer must consider the contextual real estate market of a project, as well as the motivations for mixing. Table 2 (right) summarizes how these factors correlate to an appropriate mix.

Category	Likely Housing Market	Motivation for Mixing				
		Financial	Political	Altruistic		
		Employ Less Subsidy	*Assuage Community Concerns*	*Reduce Negative Behavior*	*Improve Life Chances*	*Rebuild Heathy Community*
Moderate-Income Inclusion	High-Cost	X	X			
Low-Income Inclusion	High-Cost/ Tight	X	X	X	X	
Broad Range of Incomes	Tight/ Transitional		X	X	X	X
Market Inclusion	Transitional		X	X	X	X
Affordable Mix	Soft			X	X	X

Table 2 - The Appropriate Mix of Incomes (Source: Smith 2002)

Five Classifications of Mixing & Best Practices:

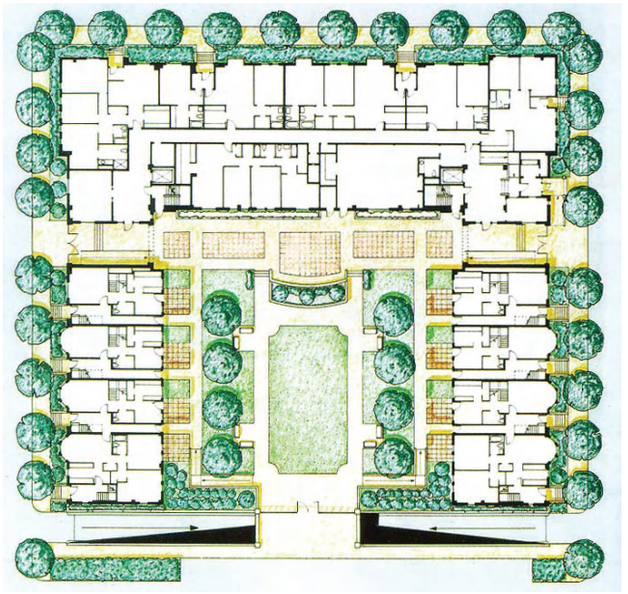
* **Moderate-Income Inclusion** projects employ the least aggressive mix, allocating just 10-20% of their units as affordable for residents who earn below 80% AMI. These projects usually **require no government subsidy** and can be privately financed. The affordable units are sometimes referred to as **"workforce units"** because they are intended for teachers, police officers, and other civil servants. These units can be offered for home-ownership, thus allowing moderate-income earners to buy into a high-cost market.

Best Practice: *Local Initiative Program 40B* in Massachusetts grants flexibility of zoning regulations to housing projects that reserve at least 20% of the ownership units for homebuyers earning less than 80% AMI. For rental projects, at least 20% of the units must be reserved for tenants earning less than 50% AMI. The goal of Chapter 40B is to encourage cities to provide a minimum of 10% of their housing inventory as affordable. Forty-seven cities and towns in the state of Massachusetts have now met that standard.

* **Low-Income Inclusion** projects employ a slightly more aggressive income mix, allocating 10-20% of their units as affordable for residents who earn below 50% AMI. These projects can be privately financed but **usually require some form of government financing or incentive.** In New York and in Massachusetts, tax exemptions and/or tax credits are offered to developers that build housing that accommodate this type of mix. The affordable units, intended to serve a lower-income population, are usually rentals.

Best Practice: *Chelsea Centro* in New York was the first development financed through the Taxable 80/20 Program of the New York City Housing Development Corporation (HDC). Through the sale of taxable bonds, HDC provided $74 million in financing for Chelsea Centro, which contains a total of 355 rental units. 71 apartments, 20% of the total development, were set aside for tenants earning up to 50% of the New York City AMI.

* **Broad Range Income** projects employ a cross-cutting income mixing strategy, allocating one-third of their units to the market, one-third to moderate-income earners, and one-third to low-income earners. These projects are **designed to attract high-income earners into a transitional neighborhood** by offering home ownership options. By offering different types of units to serve a range of income levels, these developments **offer opportunities for upward mobility** as a resident's income increases. These projects **require some government subsidy** and the project location must be good enough to attract the higher-income earners.



Plan Langham Court (Source: designadvisor.org)

Best Practice: *Langham Court* in Boston provides truly mixed-income housing in the format of a limited equity cooperative. One-third of its units are heavily subsidized low-income family homes, one-third are partly subsidized; and one-third are market rate.

* **Market Inclusion** projects allocate 10-20% of their units to the market, with the rest going to low-income earners. These projects are also **designed to attract high-income earners into a transitional neighborhood** by offering home ownership options. The goal is to bring re-investment and better services into an underserved area. In order to attract high-income earners to such areas, it may be necessary to **offer incentives to buyers** such as down-payment assistance and low-interest mortgages. **Government subsidies are required** for this kind of development.

Best Practice: The *Spring View Housing Project* in San Antonio, Texas was redeveloped using $48.8 million from HOPE VI grants. 208 rental units are designated for households with incomes under 30% AMI, and 105 ownership units sell at market rate. The San Antonio Housing Authority offered down-payment assistance and zero-interest second mortgages to market-rate homebuyers.

* **Affordable Mix** projects allocate half of their units to low-income earners and the other half to moderate-income earners. These projects are designed to **foster social connectivity and positive role-modeling** for the lower-income earners. These development projects are generally located in areas where the **market is not strong** enough to attract residents with incomes that approach the AMI. They are usually **heavily subsidized** by the government.

Best Practice: *Lake Parc Place*, a 282 unit housing project that was redeveloped by the Chicago Housing Authority in 1991. Half of the units are designated to families with one employed adult earning 50-80% AMI. The other half are for tenants earning less than 50% AMI.

Who will use this tool?

Developers and policy makers should employ Mixed-income housing development strategies to address the lack of affordable housing in the region, province, or country.

Policy makers decide the appropriate percentage of affordable housing that should be required in new residential developments within a district, city, province, or nation. Policy makers also must implement subsidy and incentive strategies for meeting such requirements.

Developers will then respond to these requirements using financing and design strategies as they see fit.

How do you decide/ measure the cost effectiveness?

There is a macro and micro level equation for measuring the cost effectiveness of Mixed-income housing:

At the **macro level**, policy makers must measure:

The overall societal costs of economic spatial segregation and concentrated poverty due to the lack of affordable housing options.

Versus

The cost of subsidizing such projects, plus the loss of revenue due to policies that force lower profit-gains on private developers.

At the **micro level**, developers must measure:

The loss of revenue generated as a result of incorporating affordable housing into an otherwise market-rate project.

Versus

The gain in subsidies, plus the gain in a project's long-term economic and social sustainability due to diversifying its population.

A wealth of literature supports the fact that urban diversity promotes economic health for a society. The performance of metropolitan economies is better where city and suburb have less income disparity.[5] In fact, interaction, or the opportunity for interaction, among diverse peoples is believed to be a necessary part of overcoming some social problems. Diversity helps build social capital and bridges networks across formerly segregated groups. In neighborhoods where there are no bridges, poverty and its associated social ills will remain persistent.

What is required to make this tool work?

In order for Mixed-income housing to work, there must be a greater societal drive to not only address the lack of affordable housing options, but also to stem the trend of income segregated development.

Once this objective is established as a priority, the government must give subsidies or incentives for allocating a percentage of new housing as affordable. Otherwise, there is no market incentive for developers, and they will continue to produce the housing that maximizes their profits.

Notable U.S. Federal Programs and Legislation include:

* Low Income Housing Tax Credit (LIHTC) - 1986
* Family Self-Sufficiency Program - 1990
* Mixed-Income New Communities (MINC) - 1990
* Hope VI Revitalization Grants - 1992
* Quality Housing and Work Responsibility Act - 1998

In order for a project to sustain a mix of households in numerous income brackets over time, developers must invest in careful planning and sound underwriting. If a development is located in an unappealing market or has poor management, it will fail to attract market-rate buyers. Conversely, if a development is well-designed, marketed and located, then it can "tip" the market beyond the reaches of the lower-income bracket.

For a Mixed-income project to be successful, developers must make sound judgments regarding:

* Location
* Amenities
* Proximity to services
* Design
* Maintenance
* Social and community activities

What are the best practices?

Aside from the projects mentioned earlier in the section on "Five Classifications of Mixing," one of the most innovative and successful Broad Range Income Projects in the U.S. is in Boston, Massachusetts.

Rollins Square is an award winning Mixed-Income community in Boston's South End, where the 184 units range in size from one bedroom flats to three bedroom duplexes. 35% of the units were sold at market rate, 45% were sold to moderate-income residents, and 20% were sold to low-income tenants – including formerly homeless people. The 2-acre courtyard complex has a below grade parking garage, park, and ground floor commercial spaces that face the

street. Following recent American trends in Mixed-income housing, the low-income tenants enjoy the exact same design standards and amenities as those who pay market-rate prices for their condominiums.

* Galster, George, *The Social Costs of Concentrated Poverty: Externalities to Neighboring Households and Property Owners and the Dynamics of Decline,* working paper presented in MIT Housing Markets Class, 2006.

Galster tries to quantify the effects of Mixed-Income neighborhoods on human behavior and arrives at the conclusion that negative externalities do not occur until the percentage of poor in a neighborhood (living below poverty level) reaches 10-15%. He also concludes that low-income residents receive greater positive externalities from middle-income neighbors, not high-income neighbors.

* Joseph, Mark J., "The Theoretical Basis for Addressing Poverty Through Mixed Income Development," *The Urban Affairs Review,* 42 (2007).

Joseph examines the theoretical rationale for using Mixed-Income development strategies to confront urban poverty. He assesses the theories on social networks, social control, and political economy. He concludes that low-income residents in Mixed-Income communities benefit most from a higher quality of life due to greater social control and access to higher quality services.

* Smith, Alastair, Joint Center for Housing Studies of Harvard University Neighborhood Reinvestment Corporation, *Mixed-Income Housing Developments: Promise and Reality*, 2002.

Though a bit out of date, this paper comprehensively examines the rationale for Mixed-Income housing development. Smith underscores that Mixed-Income developments are complex and that developers must carefully consider the housing market, the population served, financing options, and the community context.

* Schwartz, Alex, "Mixed-Income Housing: Unanswered Questions," *Cityscape: A Journal of Policy Development and Research,* 3 (1997).

This article is a bit out of date, but it develops a simple analytic framework for critically evaluating various types of Mixed-Income housing methods. Schwartz reviews the literature to date and frames a research agenda to study the unanswered questions.

* Talen, Emily, "Design That Enables diversity: The Complications of a Planning Ideal," *Journal of Planning Literature,* 20 (February 2006).

This article reviews the literature on place diversity and the design of socially and economically mixed settlements. Talen considers four theoretical bases for diversity: place vitality, economic health, social equity, and sustainability.

* U.S. Department of Housing and Urban Development, *Mixed-Income Housing and the HOME Program,* 2003

This publication provides guidance on how to use HOME funds to support Mixed-income housing development. It reviews the benefits of Mixed-income housing, provides detailed information on the considerations that will "make or break" a Mixed-income housing deal, and it highlights regulatory provisions of the HOME Program. The publication draws heavily on real and hypothetical case studies.

References

What research is still needed?

Further research needs to be done on:

* How does one apply the Mixed-Income strategy to a non-western context?

* What income thresholds "make or break" a Mixed-Income project?

* When should one employ a concentration versus dispersion method when distributing affordability across a site?

* What conditions are ideal for attracting and retaining middle-income residents in a Mixed-Income community?

* How is employment of low-income households affected in Mixed-Income communities?

Endnotes

1 New York and Boston have had Mixed-Income development financing programs since the 1970s. In Georgia, Indiana, New Jersey, and Massachusetts, State Low Income Housing Tax Credits funds are preferentially allocated to Mixed-Income development.

2 Galster, 2006.

3 *Ibid*, 2006.

4 See http://www.chapa.org/40b_fact.html for further details.

5 Ledebur & Barnes, 1993. Quoted in Talen, 2006.

Rollins Square, Boston, Massachusetts (Source: Builder Online)

FINANCING AFFORDABLE HOUSING

Claudine Stuchell

What are these tools?

These tools provide a series of financing mechanisms to make housing more affordable for Shenzhen residents. Most privately developed housing in Shenzhen is beyond the means of 70% of urban residents. These tools attempt to bridge that gap by exploring different subsidies to create affordable housing. The following mechanisms can be applied in various combinations: project cross-subsidy, interest rate subsidy, rent subsidy, and land subsidy.

What is the goal of using these tools?

The goal of these tools is to increase the affordable housing options in Shenzhen. Currently, housing prices are growing much faster than disposable income; the ratio of average house price to average household income is 9:1 in Shenzhen, and the World Bank considers ratios above 6:1 as "severely unaffordable."[1] With a population whose average age is 30 and a labor pool that is increasingly mobile, Shenzhen faces an increasing demand for more affordable and flexible housing options.[2]

On what scale do these tools apply?

At the district level, these tools require government advocacy in the forms of policy enforcement and financial subsidy. At the site level, these tools will help private developers provide more affordable housing at lower costs. At the building level, these tools will shape building form and layout, including higher density development and smaller unit sizes.

Who will use these tools?

With the "70/30 Rule" and other recent measures, the government has already established an imperative for creating more affordable housing, and these tools will provide the government with additional strategies. Developers will use the land subsidy tool to decrease development costs and thereby offer more units at affordable rates. They will use the other subsidy tools to provide residents with subsidized financing. These tools will help a greater number of residents secure good housing at affordable rates. With the variety of options, the tools will also help residents determine which affordable housing strategy and financing method best fit their circumstances.

How do you decide or measure the cost effectiveness of these tools?

Using information about the average price for residential real estate in Shenzhen, three of the subsidy scenarios – project cross-subsidy, interest rate subsidy, and rent subsidy – can be applied to determine the potential savings to consumers as well as the additional burden to those providing the subsidies, whether real estate developers, government, or residents paying full market rates in a mixed income development.

While the distributional impacts of these three subsidies can be measured, it is far more difficult and beyond the scope of this project to measure the economic impact of these subsidies, as they have implications across the economy and society.

Furthermore, it is difficult, if not impossible, to determine the true cost-effectiveness of the subsidies because full information about developers' costs is not disclosed. Although cost of construction for different building types in Shenzhen is known, data on land costs is not available. China's land market is relatively immature, with government allocations and hidden transaction costs making it difficult to accurately price land.

What is required to make these tools work?

The most crucial requirement for these tools' efficacy is government backing. The government must institute and enforce policies that mandate private developers' participation. The government must also provide subsidies to make the tools feasible. In terms of consumers, the government should institute educational programs and provide resources for the target population, who may require help when making financial decisions about their housing.

What are some best practices?

Project Cross-Subsidy: Mixed-income housing developments provide an excellent model for combining market rate and affordable rate apartments. One excellent example is The Metropolitan, a 251-unit high-rise in downtown Boston, Massachusetts, that offers 46% of its apartments to low and moderate income families. The remaining 54% of apartments are sold at market rates to help subsidize the affordable housing. The Asian Community Development Corporation (ACDC) pursued a development strategy that maximized affordability in the building by leveraging the location, transit access, and acceptable density levels to incorporate profitable, market-rate condominiums that subsidize affordable housing. Although the ACDC is not for profit, a similar strategy could be used by for-profit developers.[3]

Interest Rate Subsidy: A good example of this mechanism is the Federal Home Loan Bank (FHLB), a council of banks from around the United States that provides low-cost funds to financial institutions for home mortgage and small business loans. Through its Community Investment Program, the FHLB provides below-market-rate loans to banks, enabling them to extend housing financing to low- and moderate-income families. Funding is available continuously through a noncompetitive application process.[4]

Rent Subsidy: The United States'

Section 8 voucher program provides a helpful model for rent subsidies. In the project-based system, the local public housing authority can link up to 25% of Section 8 vouchers to a particular development, and eligible families pay 30% of their income to live there. In the tenant-based system, eligible families can use their voucher in the private sector and live anywhere they choose, paying 30% of their income and applying their government-subsidized voucher to the remaining rent. These rents are capped at a "Fair Market Rent."[5] Internet search engines can help eligible families search for Section 8 housing.[6]

Land Subsidy: A community land trust is one good model of a land subsidy. This model employs a dual-ownership mechanism, with one party holding the deed to the land parcel and another party holding the deed to housing located on the land. In this model, the government may provide and own the land, while a private developer builds and owns the housing. Another example of an effective land subsidy comes from China: the Wenzhou Housing Cooperative recently purchased a land parcel at a reduced rate, enabled through their legal status as a social organization and expedited financing channels. Their eventual housing costs will be reduced by almost 50% because of this land transaction.[7]

What research already exists & what is needed?

Although scholars have produced ample histories and criticisms of China's urban housing policies and affordable housing strategies, there exists far less research on potential tools that may alleviate China's affordable housing shortage. In particular, China's housing literature ignores the rental market and more creative tenure structures, such as collectives and cooperatives. Finally, community development corporations and other examples of public-private partnerships warrant an examination. Although cross-country comparisons and applications carry their own set of cautions, they still offer valuable methods for testing new ideas in China.

REFERENCES

Footnotes

1. "Continued Regulatory Tightening: Assessing China's New Residential Property Landscape," CBRE Research Website, January 2007, <www.cbre.com>.

2. Fang Cai and Dewen Wang, "Impacts of Internal Migration on Urban Development and Economic Growth in China," Social Science Research Council, <http://www.ssrc.org/>.

3. Asian Community Development Corporation website, <www.asiancdc.org>.

4. The Federal Home Loan Bank website, <http://www.fhlbanks.com/>.

5. U.S. Department of Housing and Urban Development website, <http://www.hud.gov/progdesc/voucher.cfm>.

6. An example of a search engine is www.affordablehousingonline.com.

7. "China's First Cooperative Housing Project," Oriental Morning Post, translated by Wind Gu for China.org.cn, 18 November 2006.

References

Affordable Housing in China: A Study of Pilot Housing Estates in Three Cities. Hong Kong: Dept. of Architecture, Chinese University of Hong Kong, 1997.

Cai, Fang and Dewen Wang. "Impacts of Internal Migration on Urban Development and Economic Growth in China." Social Science Research Council. <http://www.ssrc.org/>.

Chen, Ge. Housing in the Special Economic Zones: A Preliminary Study of Housing Provision and Conditions in Shenzhen. Hong Kong: Dept. of Architecture, Chinese University of Hong Kong, 1997.

"Continued Regulatory Tightening: Assessing China's New Residential Property Landscape." CB Richard Ellis Research Website. January 2007. <www.cbre.com>.

Davis, John Emmeus. "Beyond the Market and the State: The Diverse Domain of Social Housing." In The Affordable City: Toward a Third Sector Housing Policy. Philadelphia: Temple University Press, 1994.

Duda, Mark, Xiulan Zhang, and Mingzhu Dong. "China's Homeownership-Oriented Housing Policy: An Examination of Two Programs Using Survey Data from Beijing." Cambridge, MA: Joint Center for Housing Studies of Harvard University, 2004.

Quigley, John M. and Stephen Raphael. "Is Housing Unaffordable? Why Isn't More Affordable?" In Journal of Economic Perspectives, 17 (1).

Quigley, John M. "Caring Capitalism: How Housing Advocates Joined Government and the Private Sector to Create Low-Income Housing Policy, 1968-1993." Berkeley, CA: Fisher Center for Real Estate and Urban Economics, 2004), 3-4.

Shenzhen Statistical Yearbook. Shenzhen Statistics Bureau: China Statistics Press, 2006.

Wang, Yaping. Housing Policy and Practice in China. New York: St. Martin's Press, 1999.

Xu, Yi. "Effects of Housing Policies on Intra-urban Inequality in Transitioning China." MIT. 2005 MCP Thesis.

INCLUSIVE DESIGN

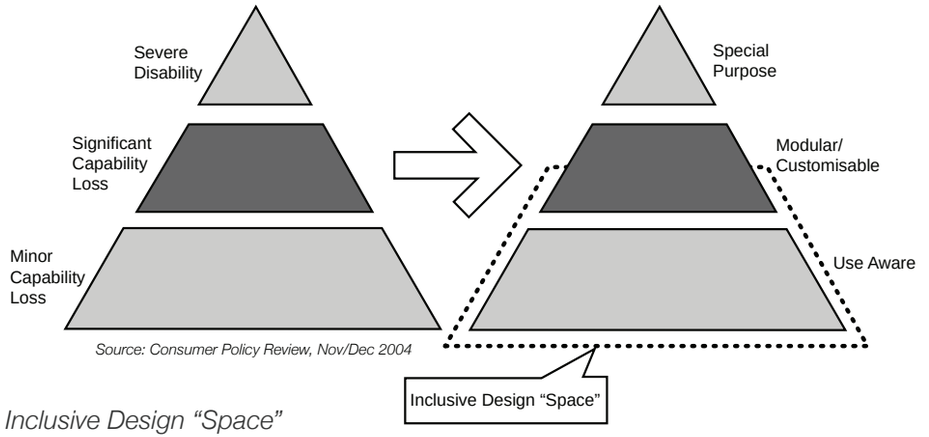
Justin Fay

Elderly Access and Unit Design

Inclusive design, also known as lifespan design, design for all, and universal design, aims to simplify life by making the built environment and products more usable by as many people as possible at little or no extra cost. Inclusive design benefits people of all ages and abilities.

Inclusive design is about making places that everyone – including the elderly, disabled, and families with small children – can use everyday with equal confidence and independence. Design affects peoples' ability to move, see, hear, and communicate effectively.

Inclusive design is guided by seven principles, that were developed by a working group of architects, product designers, engineers, and environmental design researchers[1]:



Inclusive Design "Space"

1. Equitable Use: The design does not disadvantage any group of users.

2. Flexibility in Use: The design accommodates a wide range of individual preferences and abilities.

3. Simple & Intuitive Use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

4. Perceptible Information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

5. Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.

6. Low Physical Effort: The design can be used efficiently and comfortably, and with a minimum of fatigue.

7. Size and Space for Approach & Use: Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility.

What is the goal of using this tool?

At the beginning of the 21st century, people are more aware than ever of the intensifying demographic shift toward an aging population. One of the most important things that residential developers and designers can do is help residents maintain a high quality of life while living independently for as long as possible. Inclusive design is an essential tool for achieving this goal.

All consumers – old and young – will benefit when environments and products are designed to address their needs, regardless of ability[2]:

* Inclusive design leads to increased and prolonged independence for older people.

* There will be a delay and a reduction in the need for adaptations and assistive products.

* Older and disabled people will have a wider choice of accessible and usable products.

* Through economies of scale, mainstream products are generally lower priced than low volume specialist equipment.

* More comfortable and requiring less effort, products that can be used by older and disabled people are also easier to use for nearly everyone else.

On what scale does this tool apply?

Inclusive design principles apply to all aspects of the built environment, but this particular application of the tool focuses on the residential unit and building.

Cost Effectiveness:

Commercial arguments for inclusive design are based mostly on the fact that the population is getting older, but there are other factors[3]:

* Inclusive design can be built from the start of the design and construction process at no or negligible cost; however retrospective provision or adaptation is expensive.

* Demographic data show that the elderly represent a vast, not a marginal market.

* Inclusive design does not mean designing for absolutely everyone, but for as many people as possible.

* Inclusive design does not strangle innovation. In fact, industry will need to develop innovative solutions to make their products usable by more consumers.

* A redirection of thought, not of budget, is required.

Who will use this tool?

Successful inclusive design will require developer coordination with architects, planners, product manufacturers, and product designers beginning at the outset of the design process. Ultimately, creating an inclusive place is the responsibility of developers and property managers who can ensure that their property is designed, built, and operated according to inclusive principles.

The principles relate as much to the design process as to the final product, management, and operation. Users and other potential consumers should be involved during all parts of the process from the planning phase, through detailed design to construction, occupation, management and operation.[3]

What is required to make this tool work?

Cooperation among developers, architects, and manufacturers to ensure that their environments and products address users irrespective of their age or ability. Large developers have the potential to influence architects and housing product manufacturers to incorporate inclusive design principles in their designs. Broad implementation of inclusive design principles will likely require some form of government mandate in the future, as there presently is no pressing incentive for the housing industry as a whole to change.

What are the best practices?

Making environments easy to use for everyone means considering signage, lighting, visual contrast, and materials. Adequate access to and within buildings requires not only careful attention to physical layout, but also clear communication of information to make people feel confident enough to access a building or space.

The inclusive design features listed in the tables below are adapted from research conducted by the Center for Universal Design for its Next Generation Universal Home project.[5] The Next Generation Universal Home is a concept design of ideal housing features which presently exists in the market, although their coordination in a single residential unit is uncommon. Note that suggested dimensions are based on research in an American context and should be adapted as necessary to fit other cultural contexts.

Table 1: Entrances

Inclusive Design Feature	Structural	Non-Structural
Accessible route from transit, vehicle drop off, or parking	x	
Maximum slope of 1:20 to entry door	x	
Covered building entryway	x	
5x5 foot minimum maneuvering space	x	
Package shelf or bench to hold parcels, groceries, etc.		x
Ambient and focused lighting at entry door and keyhole		x
Movement sensor light controls		x
High visibility entryway and unit identification		x

Table 2: General Interior

Inclusive Design Feature	Structural	Non-Structural
5 lb. Maximum force to open doors		x
Flush threshold (maximum of .5 inch rise)	x	
Lever door handles		x
Adjustable height closet rods and shelves		x
Accessible routes (42 inch minimum) throughout	x	
Light switches at 44/48 inch maximum height	x	
Electrical receptacles at 18 inch maximum height	x	
View windows at 36 inch maximum view height	x	
Crank operated (casement) windows	x	
Loop handle pulls on drawers and cabinets		x
High contrast, glare free floor surfaces and trim		x
5x5 foot maneuvering space in all rooms	x	
Glare-free task lighting		x
Maximized natural lighting	x	

Table 3: Kitchen

Inclusive Design Feature	Structural	Non-Structural
Knee space under sink and near cooking surface	x	
Lever-type, color-coded faucets		x
Variable height work surface 28-45 inches	x	
Contrasting border treatment on countertops		x
Stretches of continuous counter for sliding heavy objects	x	
Full-extension pull-out drawers		x
Pull-out shelves in base cabinets		x
Adjustable height shelves in wall cabinets		x
Full height pantry cabinets for up and down storage	x	
30x48 inch are of approach in front of all appliances	x	
Front-mounted controls on appliances		x
Cooktops with staggered burners to eliminate dangerous reaching		x
Glare-free task lighting		x
Non-slip flooring		x

Table 4: Bathroom

Inclusive Design Feature	Structural	Non-Structural
Toilet centered 18 inches from sidewall	x	
30x48 inch area of approach in front of all fixtures	x	
Grab bar blocking (reinforcement) in walls around toilet	x	
Grab bars in shower or tub		x
32 inch minimum bathroom counter/sink height	x	
Knee space under bathroom counter/sink	x	
Lever-type, color-coded faucets		x
Offset controls in shower or tub – set to outside for easy access	x	
Integral transfer seat in shower or tub	x	
Adjustable height shower head		x
Mixer valve with pressure balancing and hot water limiter		x
Non-slip flooring		x

The Inclusive Design Payback[6]

The adoption of these inclusive design principles will help all people safely use residential units and buildings with dignity, comfort, convenience, and confidence. People will be able to make effective, independent choices about how they move through the built environment without experiencing undue effort or separation. Following the principles set out in this section, the resulting projects will be:

* Inclusive, so everyone can use a space safely, easily and with dignity.

* Responsive, taking account of what people say they need and want.

* Flexible, so different people can use a space in different ways.

* Convenient, so everyone can use a space without too much effort or separation.

* Accommodating for all people, regardless of their age, gender, mobility, ethnicity, or circumstances.

* Welcoming, with no disabling barriers that might exclude some people.

* Realistic, offering more than one solution to help balance everyone's needs and recognizing that one solution may not work for all.

References

Books, Reports, & Articles

Blank, Thomas O. Older Persons and their Housing – Today and Tomorrow. Springfield, IL: Charles C. Thomas, 1988.

Carlson, Jodi L. and Ellen D. Taira, eds. Aging in Place: Designing, Adapting, and Enhancing the Home Environment. New York: The Hawthorne Press, Inc., 1999.

Etchell, Lindsey and David Yelding. "Inclusive Design: Products for All Consumers." Consumer Policy Review 14 (November/ December 2004): 186-193.

Fletcher, Howard. The Principles of Inclusive Design (They Include You). London: Commission for Architecture and the Built Environment, 2006.

Harber, Gilda M., chairman and Thomas O. Blank, ed. Building Design for Handicapped and Aged Persons. New York: McGraw-Hill, Inc., 1992.

Kwok, Yan-chi, ed. Ageing in the Community: A Research on the Designing of Everyday Life Environment for the Elderly. Hong Kong: World-Making Workshop, 1999.

Websites

AARP – American Association of Retired Persons. <http://www.aarp.org> (April 2007).

Adaptive Environments. <http://www.adaptiveenvironments.org> (March 2007).

The Center for Universal Design. <http://www.design.ncsu.edu/cud/index.htm> (March 2007).

Inclusive Design by Roger Coleman. < http://www.designcouncil.org.uk/en/About-Design/Design-Techniques/Inclusive-design> (April 2007).

Ricability – Research and Information for Older People and People with Disabilities. <http://www.ricability.org.uk> (April 2007).

United Nations Economic and Social Commission for Asia and the Pacific – Publications <http://www.unescap.org/esid/psis/publications/index.asp> (April 2007).

Notes

1. The Center for Universal Design. <http://www.design.ncsu.edu/cud/index.htm> (March 2007).

2. Etchell, Lindsey and David Yelding. "Inclusive Design: Products for All Consumers." Consumer Policy Review 14 (November/ December 2004): 186-193.

3. Fletcher, Howard. The Principles of Inclusive Design (They Include You). London: Commission for Architecture and the Built Environment, 2006.

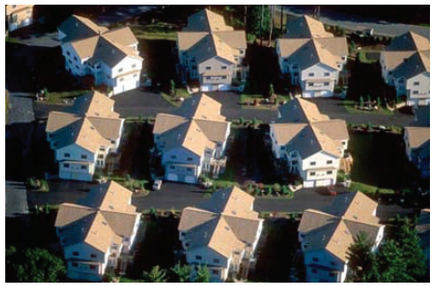
4. Etchell, Lindsey and David Yelding. "Inclusive Design: Products for All Consumers." Consumer Policy Review 14 (November/ December 2004): 186-193.

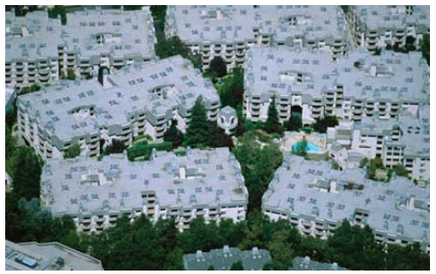
5. Carlson, Jodi L. and Ellen D. Taira, eds. Aging in Place: Designing, Adapting, and Enhancing the Home Environment. New York: The Hawthorne Press, Inc., 1999.

6. Fletcher, Howard. The Principles of Inclusive Design (They Include You). London: Commission for Architecture and the Built Environment, 2006.

DESIGNING FOR DENSITY

Kristen Hall





Introduction

Many Asian cities are already quite dense because of previous building regulations. Now, however, a growing market for luxury development has created a trend for less dense development. This type of development creates many negative environmental and social consequences, as evidenced by suburban development over the past fifty years in the United States.

The social advantages of density are increased housing opportunities, access to services, higher use of public transit systems, and reduced dependence on cars. Regional advantages of density include an increase in passive open spaces and green zones, as well as the ability to pursue a more comprehensive and rigorous environmental strategy. Hong Kong and Singapore represent good examples of cities that utilize density to their advantage. These cities have managed to sustain vital public transit services and have preserved much of their land resources as a result of their dense development patterns.

Bangkok and Dongguan, on the other hand, have not planned for density and are beginning to suffer the negative environmental and social consequences. These cities demonstrate low densities, and as a result have wasted land resources and created large, redundant road networks that create auto dependency. Furthermore, low-density development in China requires building excessive infrastructure in an economy where land is difficult to price, discouraging an environmental or regional focus on land distribution (See Claudine Stuchell's section on Financing Affordable Housing).

The goals of using these tools are to establish different ways of thinking about site planning so that developers can maximize density on a site through a variety of building types and orientations. These tools apply on the site scale but can also be translated to a citywide or even regional scale. As defined here, the tools will be most useful in regards to site design and to the developer who wishes to explore options for affordable housing. These tools can also help the government in creating appropriate guidelines for policies regarding minimum densities or more formal zoning ordinances.

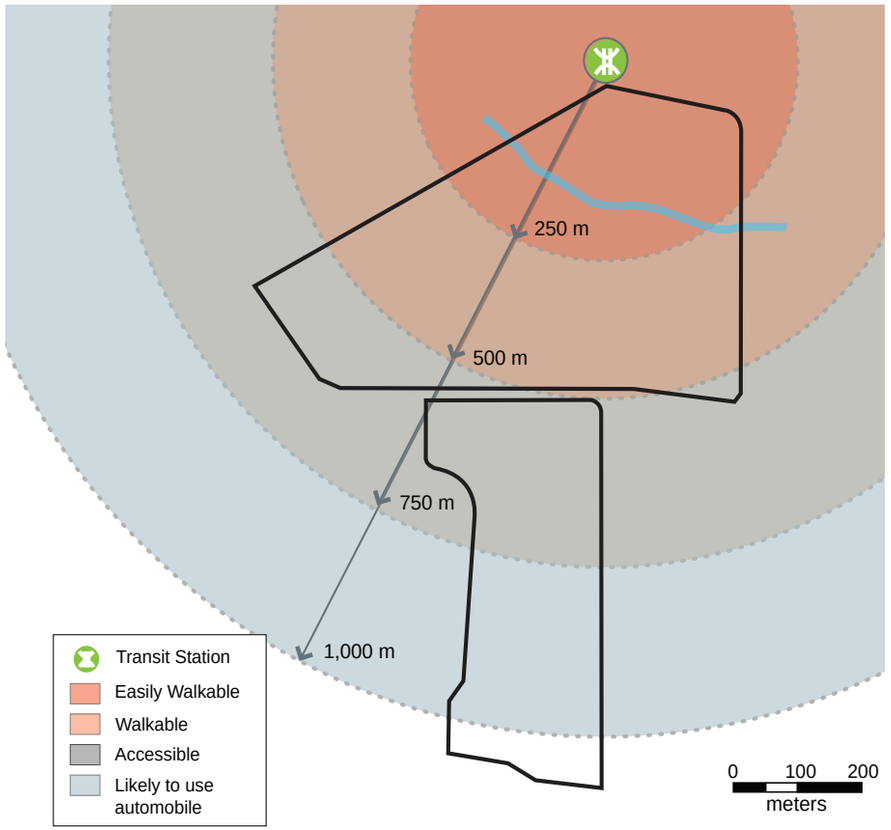
Images at left sourced from The Linclon Institute, accessed at http://lincolninst.edu/sub-centers/VD/index.aspx

Tool 1: Locations for Maximizing Density

An important element of density is deciding which areas should be dense and which areas should not. Places in a city that facilitate dense development are transit nodes, retail centers, employment centers, and areas with popular amenities such as parks and rivers. Because land values are typically higher in these places, denser development produces more revenue from the rental or sale of these apartments.

In places particularly well-served by transit, the developer can build fewer parking spaces. In the U.S., the government often imposes a minimum parking ratio per unit, limiting the ability of the developer to realize high densities. Parking takes up valuable real estate at a high cost to the developer. In places that do not have minimum parking ratios imposed on them, it would benefit the developer to take advantage of major transit nodes and maximize density near these places, as the proximity to transit reduces the need for automobiles. Furthermore, in mixed income developments, it would benefit the lower income residents to have access to smaller apartments near a transit station.

By building higher densities closer to transit nodes, the developer caters to a large demographic of people who would like to live closer to transit because they do not own cars. Planners generally rely on the rule that people will walk about 500m from their home to transit. If the developer wants to create higher density to take advantage of a nearby transit station, it is best to maximize density within 500m of the transit stop. This strategy also applies to other amenities, such as retail and employment centers.

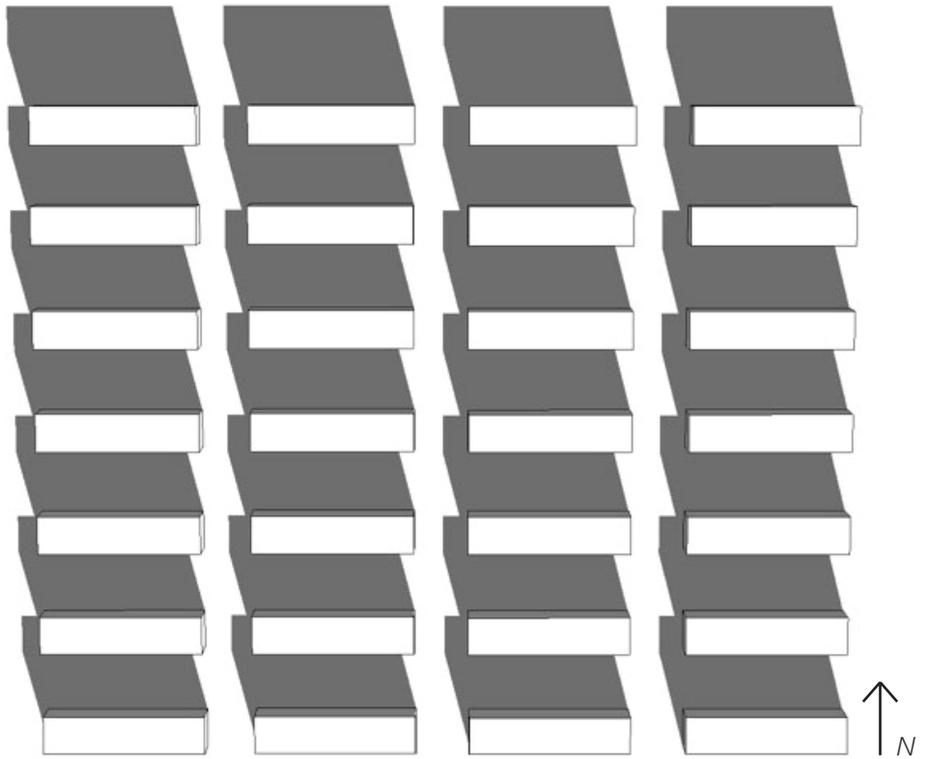


This diagram shows the optimal way to organize density around a transit node. The density starts very high at the center and slowly decreases as the buildings move further away from the transit stop. Most people do not want to walk more than 500m from their home to transit.

TOOL 2: Orienting a Building on the Site

The arrangement of buildings on a site can serve to maximize density and provide a diversity of building types. Traditionally, Chinese developers have preferred an east-to-west orientation on buildings, which maximizes sunlight for the southern-facing apartments. This site design is very effective in places like Beijing, where the winter months are very cold and sunlight serves as a natural heater. In places such as Shenzhen, however, where the climate is much warmer, this orientation is instead a negative design feature, as it produces excessive heat and creates air conditioner dependency.

By shifting building configurations from the traditional east-to-west orientation and employing different building types, it is possible for the developer to substantially increase the density on the site. The first diagram shows the more traditional east-to-west building orientation, which exposes the southern façade and casts shadows to the north of each building. In order to take advantage of this sunlight, developers must space the buildings a fair distance from each other to ensure



Lot Area: 105,000 m2

FAR: 1.57

This diagram illustrates the low density created by more common forms of development in China. The buildings are oriented east-to-west so that the apartments can receive plenty of direct sunlight from a southern exposure.

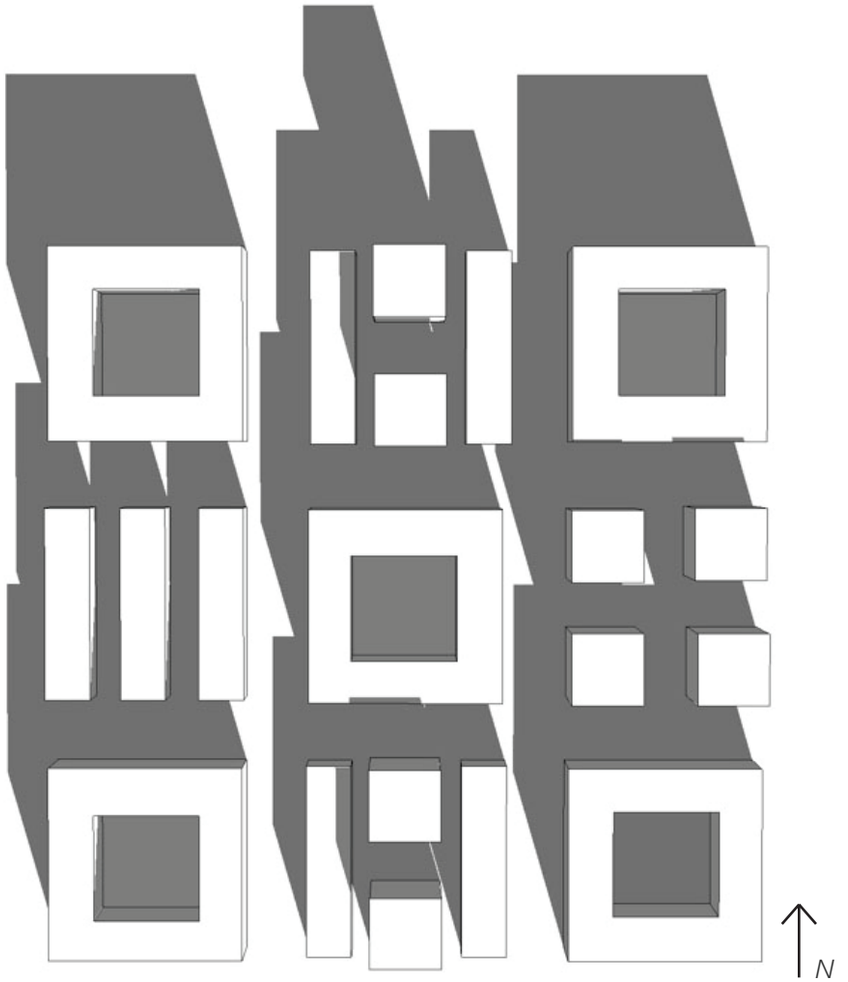
that each floor receives sunlight. This strategy lowers site density.

Alternatively, the developer can compose a site using various building types and sizes, arranging them in a more north-to-south orientation. With this approach, none of the apartments receives direct sunlight but all still receive ample daylight. The variation in building types also allows the developer to place more traditional slab buildings in a mix with towers and courtyard type buildings. This strategy creates a diversity of unit types and allows for a variety of public spaces.

Lot Area: 105,000 m2

FAR: 2.13

This diagram demonstrates how a diversity of north-south oriented building types utilizes the site more efficiently. Higher buildings and different configurations of buildings achieve a much higher density on the site than the site layout in the previous diagram.



Determining Cost Effectiveness

To maximize revenues, the developer will determine the "highest" and "best" uses for a given parcel depending on the amenities that the location offers. The cost of designing more building types will be greater for the developer who uses the same building plans repeatedly. On the other hand, this tool will be economical for the developer who is already accustomed to planning a variety of building types.

One way to determine the best density for a mixed income site is to assess market needs: how many citizens need housing and of what types? How much commercial space is needed? In lieu of policy interventions, a developer can build a diversity of housing types, unit sizes, and building heights to meet different market demands.

It is important to note that different people understand density differently. For the city dweller, perception of density is highly subjective and is crafted through urban design interventions, which, depending on their quality can make dense areas feel crowded and canyon-like, or urban and comfortable.

Vanke's courtyard system offers a highly effective method of making denser areas seem more like garden cities, but this design does not necessarily maximize density. The tools presented here primarily address the specific arrangements and locations of density, and their success depends on the developer's ability to design comfortable street life in denser areas.

Research

A large body of literature provides guidance about how and where to build density. This body of research has increased along with growing interests in Transit Oriented Development and New Urbanism. This research is increasingly relevant to China, but the connection will remain hampered as long as land prices remain hidden.

Good examples of research that hold particular relevance for this region are two theses by MIT Urban Studies and Planning graduate students: Karen Jia Ying Hu's thesis entitled "Where and How Much: Density scenarios for the residential build-out of Gaoming, China" (2005) and Sun Na's thesis entitled "Rethinking Walled Residential Compound in Peripheral Urban China" (2006). In addition, MIT's Gaoming and Shanghai Studios are very useful.

WASTE MANAGEMENT AND RECYCLING

Molly Mowery

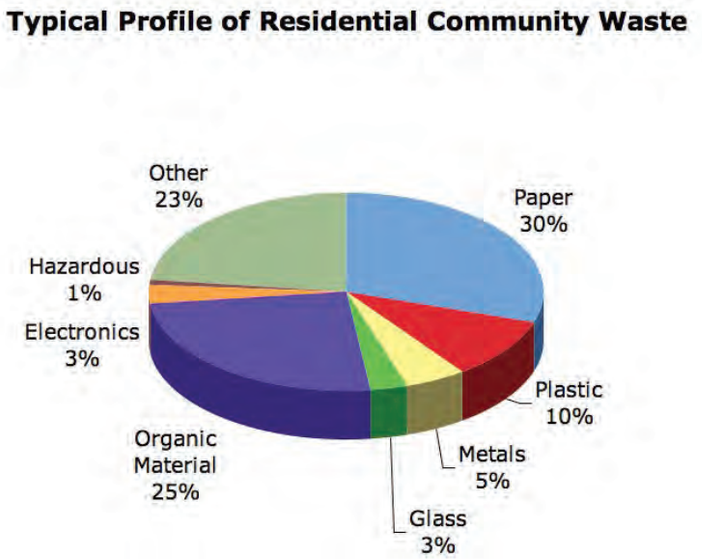
Introduction

Shenzhen's rapid urbanization requires top-notch waste management practices to ensure a sustainable future. While the majority of waste originates from manufacturing, product distribution, and packaging, residents and developers can play a crucial role in waste management solutions. Tools such as waste reduction and recycling, composting, and the reuse of building materials can mitigate waste problems typical of industrializing regions.

A Path to Waste Management

Waste burial options for southern China are running out. Experts have predicted that Hong Kong will run out of landfill space by 2010.[1] Other factors, including recent global consensus on climate change, will shape how countries approach resource conservation, energy recovery, and other waste-related issues. Waste management will undergo a necessary transformation into a more rigorous program of mandatory recycling and reuse, zero landfill waste, waste-to-energy recovery programs, eco-industrial parks, and other initiatives like composting. Government, citizens, and industry must adopt active roles in waste management in order to achieve this goal.

As trash collection becomes more expensive, technological advancements will increase the economic appeal of recycling and other resource recovery programs. Manufacturers will adhere to strict product design and packaging requirements that minimize facility wastes and maximize recycling. Residents will participate in recycling and composting programs that reduce the amount of trash taken to the landfill. Developers will face restrictions that prohibit the disposal of asphalt paving, brick, concrete, metal, and wood, which will require innovative reuse and recycling of such materials.



Typical profile of a residential community in a developed country with modest recycling and composting programs. Sources: Data compiled from summary reports of average waste produced by the U.S. Environmental Protection Agency (2003), California (2004), and Minnesota (2000).

In addition, the population will continue to grow, limiting the amount of natural resources (wood, building materials, minerals) available for future development. Such pressures will require the development industry to reuse current building materials.

Finally, climate change will continue to require mandatory recycling at the municipal level to offset carbon dioxide emissions. Recycling materials (glass, paper, wood, etc.) reduces the amount of fuel required to produce new products, while also minimizing landfill waste. Landfilling is recognized as a major source of pollution because it releases toxins into the water supply and greenhouses gases into the atmosphere.

What are these Tools?

This proposed program for improved waste management includes five primary tools: recycling, reuse and recovery of materials, composting, and innovative construction and demolition techniques. These tools address waste produced by industry and by consumers.

Reduction targets the activities of manufacturers and consumers. Examples of policies include packaging and product design laws, appropriate trash collection fees, and restricted usage of landfill capacity.

Recycling is a method of processing waste materials to make them suitable for reuse. Recycling programs should be implemented at the residential and municipal level. Example programs include curbside/bin pickup for materials such as glass, newspaper, and aluminum. As landfill capacity decreases, recycling programs have expanded to include more rigorous sorting requirements.

Reuse and Recovery programs capture the potential energy from waste materials for other uses. Sometimes referred to as the "circular economy," these programs use incineration to break down the collected waste and to produce energy. Typically such facilities are large in scale, and may be components of eco-industrial parks.

Composting is the process of collecting organic waste (e.g., food scraps, plant materials) and allowing it to decay in a contained bin for future use as fertilizer. Composting programs can be implemented on the building

Composting bins can transform food and plant scraps into rich fertilizer for gardening. Sources: (Top image) http://www.liverpool.gov.uk/Images/Garden%20waste_tcm21-45214.jpg (Bottom image) : http://www.myhamilton.ca/NR/rdonlyres/17933068-7444-4F6C-835A-C7B1DE56904B/0/BackyardCompostingProgram.jpg

and site levels, through individual bins and community-wide composting areas. Composting facilities can be developed jointly with other site amenities like community gardens.

Innovative Building Construction and Demolition Techniques incorporate recycled materials into new structures or pavement, and also recover materials from old buildings during the demolition process. These techniques ensure that landfill waste is minimized and resources are conserved. This tool requires a careful assessment of site considerations during the design phase, particularly for storage and transportation of reused materials.

What are the goals of these Tools?

* Zero Waste: Reduce the amount of waste that goes into China's landfills until it approaches zero.

* Education: Raise awareness among consumers about waste issues and their environmental impact.

* Leadership: Encourage waste reduction and recycling initiatives throughout China by setting a progressive example.

* Environmental Protection: Reduce pollutants that enter the groundwater as a result of poor waste collection methods (including improper disposal of electronics).

* Climate Protection: Reduce greenhouse gases to mitigate the effects of climate change and global warming. For example, Germany reduced an estimated 20 million tonnes of CO_2 between 1990 and 2003 as a result of its landfill ban.[2]

* Human Health and Safety: Ensure proper disposal of hazardous wastes, including toxins detrimental to human health.

* Sustainability: Conserve resources for future generations.

* Innovation: Extend the life cycle of existing building stock through the reuse of material.

On what scale does each tool apply?

* Waste reduction applies at all levels (district, site, and building scales).

* Recycling applies at all levels (district, site and building scales).

* Reuse and Recovery applies primarily at the district scale.

* Composting applies primarily on a building and site scale.

* Innovative Building Construction and Demolition Techniques apply primarily on a building and site scale.

Who will use each tool?

* Waste reduction will be driven by the government and used by all residents.

* Recycling will be driven by the government and used by all residents.

* Composting will be driven by the developer/property manager and used by all residents.

* Innovative Building Construction and Demolition Techniques will be both driven and used by the developer.

How do you measure the cost effectiveness?

Currently short-term costs may look less attractive than long-term gains, but climate protection laws may soon require all industries and residents to participate in conservation, waste reduction, and other environmental initiatives. Businesses should begin using models that combine waste and energy recovery programs.

What is required to make this tool work?

* Government regulations should require waste collection fees and enact mandatory recycling programs.

* Developers should be educated on the benefits of reusing materials in order to support proper site design, selection of materials, and demolition techniques.

* Property managers should provide on-going resident education to ensure program implementation.

* Participation by on-site businesses will close the loop between consumer and producer.

What are best practices for each tool?

Many communities around the world are engaging in environmental practices that can serve as models for Shenzhen and China. The following table lists best practices for waste management strategies. Where applicable, links to additional information on individual programs are listed below.

Source: Shutsu Chai

WASTE MANAGEMENT BEST PRACTICES		
Location	**Tools**	**Program/ Best Practice**
Chicago, Illinois United States	Recycling, Composting	Recyclable materials and compost are separated from municipally-collected garbage in Chicago. Private trash haulers are also required to provide a recycling option. Chicago provides two methods for recycling yard waste. Blue bags full of yard waste are collected with other waste; the waste is then composted by the city. In addition, the city encourages residents to compost yard waste in their own backyards. The Chicago Home Composting Program website provides detailed instructions on composting at home. Since the creation of the Blue Bag program in 1995, between 21-25% of the city's waste has been diverted from landfills annually. Among other city recycling programs, the Department of Transportation reprocesses more than 223,000 kg of asphalt from each street it resurfaces, a method that is 30% less expensive than non-recycling methods. The city's Tire Bounty Program has collected and recycled 900,000 tires since 1992. Through Household Hazardous Waste Collection events, the city has collected 23,182 liters of hazardous liquid, 1691 kg of hazardous solids and 49,290 kg of electronics.
Vancouver, British Columbia, Canada	Composting	The City Farmer program subsidizes a worm composting program for those who have balconies but no backyards. In 2007, the city will distribute 300 individual compost bins in 2007. Each bin measures 85 centimeters at the base and 85 cm in height and costs $25 (USD).
Toronto, Ontario, Canada	Waste Reduction, Recycling, Composting	Since the close of Toronto's primary landfill in 2002, the city has had no disposal site for its garbage. The city adopted a Waste Diversion Plan in 2001,which aims to reduce the amount of garbage entering landfill sites by 60% by 2008 and 100% by 2012. The city has implemented several programs to achieve this goal: Green Bin Organics Collection, Composting, Recycling in Apartment Buildings, Household Hazardous Waste, Drop-Off Depots, Commercial Waste Subsidy, and Community Environment Days.
City of Thousand Oaks, California	Waste Reduction, Recycling	The City of Thousand Oaks is a suburban community in Ventura County that meets the requirements of the California Integrated Waste Management Act. The city diverted over 66% of its garbage from landfills, established the county's largest curbside recycling program (serving over 30,000 homes), sponsors free composting workshops and a commercial recycling program that includes financial support for construction and demolition recycling.

WASTE MANAGEMENT BEST PRACTICES		
Location	**Tools**	**Program/ Best Practice**
Germany	Waste Reduction, Recycling, Energy Recovery	Germany has the highest recycling rate in the world (over 65%). Germany expanded on its 1996 waste management law when it recently banned the disposal of untreated biologically degradable waste in landfills. All waste must be treated so that it does not release pollutants when in a landfill; where possible, reusable substances must be recovered and waste must be used as fuel.[3] More than half of the waste from private households and production is recovered. In some areas, as much as 80% of the waste is recovered, including 86% recovery in the building sector. The total volume of waste being recovered is 28 million tonnes of domestic waste, 31 million tonnes of waste from production and trade, and 162 million tonnes of construction and demolition waste. This is equivalent to the recovery of about four tonnes of waste per capita (roughly the weight of four small cars). The contribution of modern waste management to climate protection is remarkable: over the last 15 years, the emission of greenhouse gas pollutants from waste management was reduced by 30 million tonnes of CO^2 equivalents per year. Environmental protection has become critical to the German economy. More than 250,000 people in Germany work in waste management – from engineers and refuse workers to civil servants. Several colleges offer waste management courses, and special professional training in waste management is available. The annual waste management economy exceeds 50 billion euros.[4]
Japan	Waste Reduction, Recycling	Japanese law requires rigorous recycling practices. The 1997 Receptacle Packaging Recycle Law places the responsibility for recycling glass bottles and some plastic bottles (polyethylene terephthalate, or PET) on manufacturers. The law divides the cost of garbage disposal among producers, consumers, and municipalities. The 2001 Electric Appliance Recycling Law requires that disposed electric appliances (air conditioners, televisions, refrigerators and washing machines) must be collected by retailers at consumers' expense and recycled by the manufacturer.[5] Yokohama, Japan, requires all citizens to sort and recycle their trash into ten garbage categories. The city provides residents with a 27-page guide to sorting that includes the separation of cosmetics, kitchen utensils, and clothing. Yokohama's goal is to reduce the incineration of garbage by 30% over the next five years. Kamikatsu, Japan, has enacted waste laws that seek to eliminate all garbage by 2020. Recycling waste rates in the town are nearly 80%. Each household receives a subsidized garbage disposal unit that recycles raw garbage into compost.

WASTE MANAGEMENT BEST PRACTICES		
Location	**Tools**	**Program/ Best Practice**
USA	Construction Practices	U.S. Green Building Council's LEED Neighborhood Development Rating System includes a credit for Building Reuse and Adaptive Reuse. The credit requires projects to incorporate the reuse of one building that maintains at least 50% of the existing building structure (based on surface area) and envelope (including exterior skin and framing and excluding window assemblies and non-structural roofing material).
Massachusetts, USA	Demolition Practices	The Massachusetts Department of Environmental Protection, Boston Society of Architects, and Associated General Contractors of Massachusetts issued a "Recycling Construction and Demolition Wastes – A guide for architects and contractors" in April 2005. This report outlines reasons for recycling construction and demolition wastes, explains how to identify recyclable materials, distinguishes between demolition and renovation projects and new construction projects, and identifies general barriers and solutions to recycling and disposal of building materials.
European Union	Waste Reduction	The European Union began actively promoting reuse and recycling among all EU nations in 1994. A 2004 directive increased the recovery target to require that a minimum of 60% (by weight) of all packaged wastes must be recovered or incinerated at waste incineration plants with energy recovery by December 31, 2008. In addition, between 55 and 80% (by weight) of all packaging must be recycled: 60% of glass, 60% of paper and board, 50% of metals, 22.5% of plastics, and 15% of wood.

What research already exists?

Many local and national governments, as well as various industry sectors, have already developed waste management programs, demonstrating that they are feasible. Because some tools are appropriate for municipal implementation, while others require the expertise of developers, the following sources have been divided into four categories: industry programs, regulatory agencies, individual city programs, and general literature.

Industry Programs and Literature:

-United States Green Building Council – LEED Neighborhood Development Rating System

www.usgbc.org

-Indigo Development - A consulting company that applies industrial ecology to the challenges of local and regional sustainable development)

http://www.indigodev.com/Circular1.html

(Existing Research, Cont'd)

-NISP – Industrial Symbiosis case studies and approaches.

http://www.nisp.org.uk/about_us.aspx

-The Institution Recycling Network – Recycling Construction and Demolition Wastes (A Guide for Architects and Contractors). April 2005. http://www.wastemiser.com/CDRecyclingGuide.pdf

National Regulatory Agencies:

-European Union

Packaging and Packing Waste Information: http://www.europa.eu.int/scadplus/leg/en/lvb/l21207.htm

-Germany

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

http://www.bmu.de/english/waste_management/latest/aktuell/3865.php

-Japan

Web Guide to information about Japan and the Environment (including Waste Management and Recycling)

http://www.fpcj.jp/e/mres/publication/jp/society/env.html

-United States

Environmental Protection Agency (Municipal Solid Waste Generation: Recycling, and Disposal in the United States

www.epa.gov

City Programs:

-Chicago, Illinois, United States

Chicago Recycling Coalition: http://www.chicagorecycling.org/index.php?option=com_content&task=view&id=24&Itemid=116

City policies: http://egov.cityofchicago.org/city/webportal/portalEntityHomeAction.do?entityName=Recycling+Chicago&entityNameEnumValue=148

-Vancouver, British Columbia, Canada

Solid waste and recycling information: http://www.city.vancouver.bc.ca/engsvcs/solidwaste/

http://www.city.vancouver.bc.ca/engsvcs/solidwaste/recycling/index.htm

Toronto, Ontario, Canada
Green Guide: Waste and Recycling: http://www.toronto.ca/greenguide/waste_recycling.htm

General Literature:

Roseland, Mark, *Toward Sustainable Communities* (British Columbia, Canada: New Society Publishers, 2005).

"WasteNet" – A general web resource for waste management: http://www.wastenet.net.au/

References

1. Japan Fact Sheet, Ministry of Foreign Affairs: (http://www.mofa.go.jp/)

2. Dehouse, et al, "Status Report on the Waste Sector's Contribution to Climate Protection and Possible Potentials," paper commissioned by the German Federal Environmental Agency, August 2005.

3. Susanne, Hempen, "Status and Trends of the Residual Waste Treatment Options in Germany," paper presented at The Future of Residual Waste Management in Europe conference, 2005.

4. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany. http://www.bmu.de/english/waste_management/general_information/doc/4304.php

5. News Release: "Announcement of Home Appliance Recycling Performance by Home Appliance Manufacturers (2004)," Ministry of Economy Trade and Industry/ Japan Ministry of the Environment, May 27, 2005.

STORMWATER MANAGEMENT

Sophie Martin

What is This Tool?

These tools consist of implementing Low Impact Development (LID) best practices aimed at reducing and managing stormwater runoff. Specifically, these tools are: installation of vegetated buffers and/or filter strips, installation of dry bioretention ponds, increased use of permeable pavement, and reconsideration of site design to minimize runoff. The **goals** are to:

* Enhance environmental quality of the site and surrounding area by replicating pre-existing hydrologic conditions on the site through improved design. This helps recharge aquifers and improve groundwater quality;

* Minimize the amount of unfiltered stormwater discharged into Shenzhen's drainage system;

* Reduce overall site-wide water needs by harvesting and recycling rainwater in the following ways:

1) Expand existing rooftop rainwater capturing system to more of the site,

2) Develop a natural system for capturing, filtering, and then reusing stormwater that falls to the ground; and

3) Lower landscape maintenance costs and increase residents' comfort during times of heavy rainfall by managing stormwater runoff naturally and efficiently.

Rationale and Assumptions

Shenzhen and the Pearl River Delta are rapidly growing, placing increasing pressures on the region's water resources and infrastructure systems. Growing residential and industrial development increases the consumption of fresh water, the source of which is already shared with Hong Kong, as well as generation of waste water. Additionally, urbanization causes an increase in impervious surface cover, exacerbating stormwater runoff and straining cities' storm and waste water treatment systems. Given its subtropical climate, which includes prolonged dry and rainy spells and a monsoon season, stormwater management is of great relevance to Shenzhen. Government officials in Shenzhen are already aware that the city is too wasteful in its water consumption. Its supply is limited and shared with other large cities in Guangdong Province. It is likely that within a decade or two, new developments will be required by the government to collect and reuse anywhere from 60 to 80 percent of the stormwater that falls on the site. By incorporating comprehensive stormwater management tools into new developments and making some simple retrofits to existing ones, developers in Shenzhen can use water resources more efficiently and mitigate some of the negative environmental impacts of growth and development.

Current Conditions

Vanke recognizes the importance of conserving potable water and collecting and reusing rainwater. They have expressed concern that residents use tap water for uses such as watering gardens and washing their cars. In order to reduce tap water usage, rooftop water harvesting technology has been put in place at Wonderland. Rainwater is collected from rooftops and channeled into underground cisterns. After sufficient time is given for sedimentation, the water is pumped back to the surface and used for watering landscaping and washing cars.

While this system required significant

upfront investment at the time of building, Vanke decided that this technology was ultimately more economical than well collection and permeable ground tile collection. However, this initial analysis does not explore various LID stormwater management tools that can collect and filter ground rainwater more effectively and improve the ecological functioning of the site.

Best Practices Appropriate for the Site

Vanke's key concerns are that the tools are easy to maintain and make use of the existing stormwater management network already on site and in the district, and that it should continue to function under heavy rain (i.e., monsoon conditions) to the best extent possible. Also, due to Shenzhen's climate and subtropical location, the tools should avoid solutions that involve standing water, which are breeding grounds for mosquitoes and other pests.

As described above, Wonderland already has some technology in place for collecting, filtering and reusing rainwater from rooftops. Hence, the best practices mentioned here will focus on sustainably managing and reusing stormwater that hits impervious ground surfaces.

The best practices posed here are:

Installation of vegetated buffers, filter strips and/or grass swales, particularly alongside long impervious pedestrian ways and roads. These tools are linear vegetated areas that intercept ground runoff, slow it down, and partially filter it. Grass swales are depressions where water can be absorbed into the ground after running through the filter area. However, they are not meant to handle large of a volumes of water. Filter strips and buffers are often used in conjunction with bioretention ponds, to slow and partially filter and absorb the first flush of runoff as it is channeled towards the ponds. Replacing traditional gutters with slightly wider grass strips can significantly reduce the amount of runoff that flows to the more comprehensive management system. In fact, the City of Seattle's Street Edge Alternative (SEA) project managed to control most runoff through installation of strips and swales in combination with heavy vegetation.

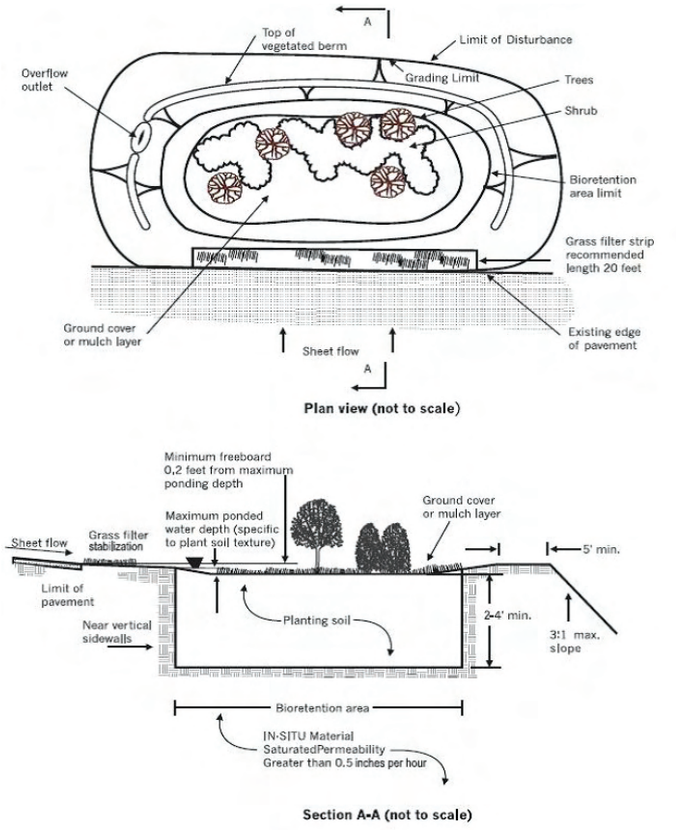
Installation of larger dry bioretention ponds. Bioretention ponds are landscaped depressions into which surface runoff is directed. They are often bordered by the vegetated buffers described above, which reduce the speed and volume of runoff entering the ponds. Filled with porous soil and mulch and planted with native hydrophilic plant species, the ponds remain dry at most times in order to avoid

Current gutters at Wonderland lend themselves to replacement with grass swales and strips.
Source: Molly Mowery

Seattle's SEA Streets utilizes simple swales to control runoff. Source: City of Seattle Public Utilities.

standing water. Ground runoff that is channeled into bioretention ponds is naturally treated and cleaned through the filtration process. The water then may be allowed to percolate back into the natural soil and recharge the underlying water table, or it may be collected and stored via a connecting pipe and cistern for reuse on site in a manner similar to the rooftop water. Because of Shenzhen's water conservation needs, Vanke would likely pursue this latter option in most instances.

During a storm event, the rain collects in ponds above the mulch and vegetation and gradually filters down through it. Because of Shenzhen's monsoon climate, bioretention ponds will be most effective when linked together into a system. In this scenario, water is funneled downhill through adjacent ponds as each one reaches capacity. This type of linear system is well suited to the Wonderland site, where wide, gradually sloping pedestrian paths can accommodate installation and generate the type of ground runoff this tool is fit to handle. Ponds are also equipped with an outflow drain underground that can pass the water through to the municipal system in the event of massive flooding. When used in conjunction in a network of the other tools, bioretention ponds can help manage large volumes of runoff during most



Bioretention pond in plan and section. Similar designs also have an outflow pipe. Source: PG County, "Low Impact Development Design Strategies" 1999, page 4-10

Integrated linear bioretention ponds can manage large volumes of ground runoff by linking many smaller components. Source: Kevin Perry, Bureau of Environmental Services, City of Portland, November 2005

large storm events. Overall, the total ground area devoted to bioretention ponds should equal approximately 5 - 10% of the total drainage area (Davis and McCuen, 2005).

The SW 12th Avenue Green Street Program in Portland, Oregon is a good example of a linked bioretention pond system; their system of ponds manages almost all of the drainage area's annual runoff (see case study in Existing Research section to follow).

Increased use of permeable pavers where appropriate. Municipal regulations already require the use of permeable pavers on surface parking areas, but the large amount of paved area on the site provides an opportunity for increased use of this and other types of permeable surfacing.

Reconsideration of site design in order to minimize and disconnect impervious surfaces so as to reduce sheet runoff, link open spaces, and possibly restore original natural hydrologic systems.

Where Does This Tool Apply?

The stormwater management tools described here are meant to be applied both at the site and courtyard level. While some techniques or specific practices are implemented on the courtyard scale, they must be integrated across the site in order to achieve maximum efficacy. Similarly, any design recommendations for the entire site will be manifested at the courtyard level as well.

Planning for water management at the site level should be an opportunity to identify ways in which the natural systems of the site can be linked to those of the district and region. This is particularly relevant for the restora-

tion of natural systems on the site (e.g., streams) that connect directly to areas outside of the site. Also, understanding the region's climate and rainfall patterns is crucial for finding appropriate and successful stormwater management practices.

Cost Effectiveness and Feasibility

Developers are sometimes resistant to implementing low impact development tools because they fear that construction costs will rise without increasing revenue. Incentive to practice these tools is even lower when there is no government policy that encourages or requires them. However, many LID stormwater management tools are actually cheaper to install and operate than conventional methods. Dry grass swales and bioretention ponds are similar in cost and are two of the least expensive of these tools, costing approximately $0.19 per liter ($5.50 per cubic foot) of storage (HUD 2003).

Additionally, some stormwater management tools, particularly those related to site design that result in increased green space and vegetation, or those that reduce residents' utility costs, may result in faster sales of residential units. Because Vanke is responsible for care and maintenance of its buildings and surrounding landscaping even after the units are sold, implementation of these tools will also cut down on maintenance costs and increase customer satisfaction.

What is Required to Make This Tool Work?

Because stormwater management tools that are implemented at the site level aim only to lessen the impact on the city's greater infrastructure system, rather than make any changes to the district-wide infrastructure, there should be no explicit political context necessary for implementation of best practices.

The developer is the primary actor in the implementation of stormwater management tools at the site and courtyard level. These tools are best applied to new development and integrated into the planning and design process from the beginning; however, it is possible to retrofit existing sites to some degree in order to improve stormwater management in already built-up areas. LID tools require some minor maintenance after construction.

Action by the government is only necessary if a particular practice or design conflicts with established regulations such as zoning or building codes. However, the Shenzhen government already requires implementation of certain types of stormwater management tools, such as permeable pavers for surface parking, so it is probable that local government would be amenable to further efforts to that end. The government would need to initiate a study, set up regulation requiring use of these tools, and enforce it.

Action by residents is not necessary for the implementation of site-level stormwater management tools. Residents may become involved in a water resource management if an outreach effort regarding water demand reduction is included.

Existing Research (Literature Review)

Davis, Allen P. and McCuen, Richard H. *Stormwater Management for Smart Growth.* New York: Springer, 2005.

Davis and McCuen discuss the concepts and tools behind stormwater management within the framework of smart growth. The thesis is that sprawling development patterns have exacerbated stormwater management problems through the increase of impervious surfaces and disruption of natural systems. This is combined with a technical manual for designing stormwater management tools, and it includes sections on vegetation methods and Low Impact Development site design.

Ferguson, Bruce K. *Introduction to Stormwater: Concept, Purpose, Design.* New York: John Wiley and Sons, 1998.

Ferguson's text primarily targets civil engineers who must design stormwater management tools to technical specifications. It explains what tools are most appropriate given soil type, climate and rainfall, and other site characteristics. However, most examples cited are from the United States, which does address monsoon climate zones similar to that of southern China.

Prince George's County Department of Environmental Resources. *Low Impact Development Design Strategies: An Integrated Design Approach.* Largo, MD: PG County Department of Environmental Resources Programs and Planning Division, 1999.

This manual explains the principles and goals behind LID methods, focusing particularly on Integrated Management Practices (IMPs) – small, discrete tools and management units that, when used in conjunction across an entire site, eliminate the need for one large, centralized treatment facility. This approach is recommended for Wonderland and other similar Vanke sites. The report covers site planning, hydrologic analysis, erosion and sediment control, and public outreach and education related to these IMPs.

U.S. Department of Housing and Urban Development, Office of Policy Development and Research. *The Practice of Low Impact Development.* Washington: US HUD, 2003.

The Housing and Urban Development report project discusses Low Impact Development best practices relating to project planning and design, including site analysis and circulation design considerations; tools for water management, which are split into stormwater management; wastewater treatment; and alternatives to conventional systems. One of the most useful aspects of this resource is its comparison tables between conventional and alternative LID tools, which contrast both upfront and ongoing maintenance costs of the various stormwater management methods.

Other Work Cited:

Wong, Kwan Yiu, ed. *Shenzhen Special Economic Zone.* Hong Kong: Tai Dao Publishing Co., 1982.

This book describes the history of Shenzhen and the Chinese government's rationale for creating the Special Economic Zone (SEZ). It outlines the demographic, economic and environmental conditions prior to the area's designation as an SEZ, and describes various plans for the region moving forward. For this research, this study was especially helpful for determining the preexisting natural conditions in and around the site.

Internet Resources

http://www.lowimpactdevelop-

ment.org/home.htm

http://www.stormwatercenter.net/

Both of these sites are excellent resources for basic research and case studies (again, mostly from the United States). Additionally, the Stormwater Center site provides excellent fact sheets on individual tools and site design ideas.

Case Studies

SW 12th Avenue Green Street Project, Portland, OR.

A component of the City of Portland's Sustainable Stormwater Management Program. Profile available online at http://www.asla.org/awards/2006/06winners/341.html. This project seamlessly integrates natural stormwater management into the existing urban street network and pedestrian zone. Ground runoff from the streets is channeled into a series of linked landscaped stormwater planters so that the water level never exceeds 15cm; excess capacity is eventually redirected back into the municipal system. Water infiltrates into the soil at a rate of 10cm per hour. It is estimated that this system is capable of managing almost all of the block's annual runoff of 681m^3 (180,000 gallons).

Street Edge Alternatives (SEA Streets) Project, Seattle, WA. Profile available online at http://www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/Natural_Drainage_Systems/Street_Edge_Alternatives/index.asp. This pilot program has been implemented on several city blocks in a north Seattle neighborhood. The project reduced impervious surfaces to 11% less than a traditional street and reduced total stormwater volume leaving the area by 98% through street and parking impervious area reduction, installing numerous grass swales alongside roads and sidewalks, and dramatically increasing vegetation (over 100 trees and 1,100 shrubs planted).

Areas for Further Research

As alluded to in the literature review above, case studies and examples from the current literature on LID stormwater management tools are largely limited to North America and Europe. This is relevant from a climate perspective; without examples from southeast Asia or other areas that have monsoon weather patterns, it is difficult to determine how most of the tools described here would fare under these more extreme rainfall conditions. Most southern or southeast Asian areas are either very densely urbanized or very rural, and there is little suburban development similar to what is encountered at the Wonderland site and elsewhere in Shenzhen. Therefore, any innovative stormwater management tools employed in these other areas may not apply as directly to Vanke's sites.

COMMUNITY EDUCATION

Shutsu Chai

Scenario

* Increased demand on the Pearl River Delta for water will cause water shortages, increasing water costs.

* Frequency of natural storms due to global warming will demand better storm water management systems.

* Energy shortages will cause energy costs to rise. Renewable energy will become economically viable.

* Packaging materials will have more stringent standards. Recycling will create significant economic benefits.

* Stringent government requirements will provide developer incentives to fund community education.

What Is This Tool?

Community education is a key component of resource management and is the implementation of *any* tool. This education tool will demonstrate how Vanke, a developer, can influence best practices through educating their residents. In order for the conservation and management of limited resources to be truly successful, cooperation at all levels of the community will be needed. This cooperation ranges from the resident in his own home to government policies that set minimum standards or restrict flows of additional resources. Through increased awareness of limited resources and best practices, residents and developers will be able to better manage and conserve those resources. Within high-density Vanke developments, these practices may have significant impacts. For illustration purposes, this tool will focus on water management, recycling, and conservation.

Components of this tool

A myriad of community education and outreach strategies can be used alone or in various combinations.

Potential Strategies

Education Programs Requiring Active Participation

* Schools

* Public art programs

* Recycled products and re-used materials placed in community

* Community gardens

Education Through Incentives

* Rebates

* Competitions

Passive Educational Elements

* Signs for visibility of interventions and practices

* Informational boards and booklets

* Technology

These strategies can be used alone, but may be more effective when used as part of a larger education and awareness program.

What Is The Goal Of Using This Tool?

Individual actions, when aggregated, can have a large impact. Consequently, the goal of using this tool is to encourage and teach residents how to manage limited resources, such that individual

residents will change their attitudes and behaviors towards resource management, including energy conservation, recycling, and stormwater treatment.

In order to measure the effectiveness of this tool or the level to which education programs are sufficient at achieving this change in behavior, a baseline of resource consumption and resource management per capita must be measured before the tool is implemented. The benefits of these educational strategies can then be measured each year. These measurements may include: average energy consumption rates per unit, tons of trash generated per year, tons of recycled products, yearly site runoff or yearly volume of reused gray water or harvested rainwater.

On What Scale Does This Tool Apply? (Table 1)

This tool applies on all scales, although each strategy will be more appropriately initiated at different scales. The following table demonstrates the optimal scale(s) of operation and application for each tool.

Who Will Use This Tool? (Table 2)

Just as the process of community education is three-pronged in its scale of application, the scale of involvement in each strategy also occurs at three different levels – developer, government, and residents - where each identified group can initiate the education strategy with varying roles and ranges of impact.

Table 1

OUTREACH STRATEGY	ON WHAT SCALE CAN THIS TOOL APPLY?		
	District	Site	Building
Schools	X	X	X
Public Art Programs		X	X
Signs		X	X
Community Gardens		X	X
Rebates	X		
Competitions	X	X	X
Informational boards & booklets	X	X	X
Technology	X	X	X

Table 2

OUTREACH STRATEGY	WHO CAN USE THIS TOOL?		
	Developer	Government	Residents
Schools	X	X	
Public Art Programs	X	X	X
Signs	X	X	
Community Gardens	X	X	X
Rebates		X	
Competitions	X	X	X
Informational boards & booklets	X	X	X
Technology	X	X	X

How Do You Determine The Cost Effectiveness of This Tool?

There are three primary hurdles to assessing cost effectiveness:

1. The education provider does not necessarily (and most likely will not) receive the economic benefit. Resource management is more difficult to measure, but it does have the potential to improve a place through better practices, making a developer willing to invest despite less direct economic benefit. Consequently, cost effectiveness can be a justification when looking at all scales of application – government, developer, resident - in aggregate, but not at each scale alone.

2. Economic benefit to residents may not occur immediately, even with rebates. In fact, the monetary amount may be difficult to measure in many components of stormwater and waste management; examples include increased permeable pavement or increased recycling. Outside of government economic incentives that may bring monetary returns and gains, the monetary benefit of such a tool is difficult to assess.

3. Resulting economic benefits will be difficult to attach to any particular aspect of a multi-pronged education program. Consequently, it will be difficult to measure the cost effectiveness of each different strategy and to sift out the most cost-effective aspects of the plan. Again, only the aggregate can provide a potential measure of cost-effectiveness.

Despite these setbacks in measuring cost-effectiveness, many of these sub-interventions below the umbrella of community outreach do have measurable monetary amounts. For example, volume of rainwater harvested reduces the volume of clean water needed for landscaping. Consequently, harvested water has a monetary amount that can be compared to the education strategy cost. Another example can be any energy conservation education program – the cost savings can be measured and compared to the monetary input to the education program. But, again, while the cost- effectiveness can be evaluated in the aggregate, the provider of the education is likely not the recipient of the cost savings. A potential solution may involve a temporary benefit-sharing system to provide incentive for an education program in addition to engaging residents in best management practices.

What Is Required To Make This Tool Work?

In order to make community education work, there are three concerns that must be addressed:

1. Incentive must be provided for the developer or government to sponsor these education programs for residents in the form of a benefit sharing policy or strategy.

2. People will need to understand and be willing to bear the initial cost of deploying best practices without immediately seeing results, especially financial results.

3. Residents will need to understand that the aggregate of their actions can have a large impact, even if the individual action does not seem to have significant impact on the whole. The aggregate is all the more important in these developments because of the high density.

What Are Best Practices?

Best practices will vary based upon the tool that is selected. To illustrate the best practices, this section will clarify each strategy, outline best practices, and provide several existing examples or initiatives.

Schools

Children are an important target of the community education tool. As children will become the adults of tomorrow, practices and habits engendered in children have the potential of becoming the norm as that generation reaches adulthood. Schools are significant in this education process because most children spend the bulk of their day at school.[1] In addition, children take home whatever practices are learned during the day, serving as "pupil ambassadors" to the rest of the community.[2]

Outreach through the schools involves teaching children best practices through the curriculum and activities such as community gardening, another tool that will be discussed later. The integration of resource management practices into classroom teaching, as well as hands-on activities and projects, will teach children how to best conserve and reuse limited resources.

Case Study: Maryland Association for Environmental and Outdoor Education, Green School Program

Beach Elementary School, Green School Program participant. Source: www.maeoe.org/greenschool/overview.html.

This program offers schools a "Green School Certification" process to encourage their environmental education efforts. Environmental education uses classroom studies combined with best management practices and involves the community.[3]

Public Art Programs

Public art programs can take many forms, but the underlying premise is an activity that is accessible by all age groups, engages residents in an art activity related to some aspect of resource management, subsequent prominent display, and engenders a sense of ownership and responsibility for that aspect of resource management.

Developing such programs requires creativity on the part of the planner, especially as any program needs to be tailored to each target population and each target resource management practice. The following case study suggests what public art programs may look like, but cannot prescribe the specific art program that will be most appropriate.

Decorated Trashcans from TrashED Program. Source: www.globalinheritance.org/trashed/

Case Study: TRASHed: Art of Recycling

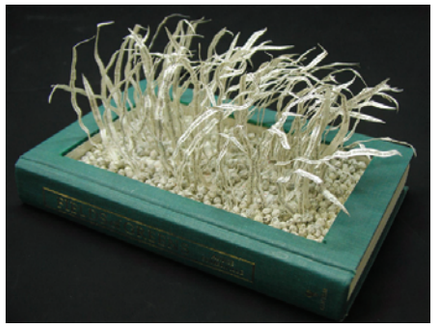
TRASHed is a program by Fashion Peace that uses art – painted and decorated trash and recycling bins – to redefine the way that people and businesses view recycling and trash collection.[4] The bins fit into the environment by replacing existing bins, affecting views on waste management. This program has been permitted in many United States cities, engaging a wide variety of artists and displaying the artwork in various locations and events.

While most of these bins are painted by artists, such a program need not be so exclusive. The program should involve community members to change behavior towards resource management, creating pride in resulting art pieces and an increased visibility and awareness of recycling.

Recycled Products/ Reused Materials

Recycled products and reused materials (e.g., building materials) are an extension of the public art program strategy, where the art produced – whether by residents or designated artists – is displayed in a visible manner. The purpose of displaying recycled products and reused materials is two-pronged. The first goal is to recycle and reuse something that has either become obsolete or would otherwise be disposed of to a landfill. The second goal is to use recycled products in a visible, memorable and aesthetically pleasing way to create an appreciation, awareness and respect for recycling.

Case Study: "Long Overdue: Book Renewal," Portland (Maine) Public Library



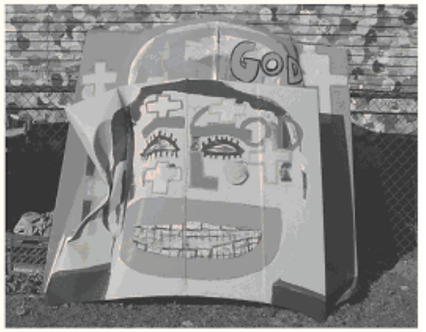
"Field of Greens." Reused Book from Portland Public Library. Source: http://www.meca.edu/Meca_Galleries/Altered_Book.aspx.

Artists from the Maine College of Art were invited to turn 186 old books that were no longer fit for circulation into art. These books were altered by the artists and then put back into circulation as pieces of art that could be borrowed and returned, much like the original books. These creative ways of reusing objects that have lost their intended usefulness provide a way to recycle the object and draw attention to the potential of reusing products.[5]

Case Study: The Heidelberg Project (Detroit, MI)

"Using art to provoke thought, promote discussion, inspire action and heal communities…"

In the Heidelberg Project, abandoned

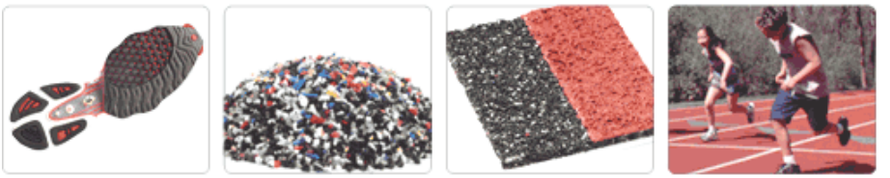


"Faces in the Hood." Paintings on old car hoods. Source: Reinventing Downtown: 2005 Rudy Bruner Award for Urban Excellence.

materials are recycled and used as a medium for art. Particularly in this case, the items and modifications are chosen with the intent to bring attention, to create a dialogue, and engender learning about social issues in Detroit, Michigan. This strategy can similarly bring awareness of resource management, beyond simply reusing something that has been discarded by its original user.[6]

Case Study: Nike Reuse-A-Shoe Program

Old sneakers are ground up to make running tracks, basketball courts and tennis courts. Soccer fields and playgrounds surfaces can also be made from recycled shoes.[7] These innovative strategies of reusing everyday products like shoes provide a way for every member of the community to contribute to the larger recycling project that is ultimately visible evidence of the usefulness of recycling and personal contributions.



Turning Old Sneakers into New Surfaces, Nike Reuse-A-Shoe Program. Source: www.nike.com/nikebiz/nikebiz.jhtml?page=27&cat=reuseashoe&subcat=us-surface.

Signage

Signage can raise awareness of these programs and an understanding of the importance of best practices. For example, a virtually invisible drainage swale can be enhanced by a sign indicating its location and the role of this system in flood prevention. Signage can also make distinctions between buildings that have greater sustainability, creating a social incentive for greener buildings even if the economic benefit is delayed. Furthermore, creating signage can also become a community activity, where participation raises awareness.

Signage can also help direct resident behavior, providing information about how they can protect the environment or how particular actions may impact the environment. Signage can be greatly enhanced through the use of technology, a capability that will be discussed in greater detail through the technology tool.

Case Study: City of Bothell, North Creek Project

As a part of a larger creek cleanup and education project, storm drain stenciling educates residents about where drains lead and explain why they should not dump into these drains.[8] Through provision of information through these signs, the City of Bothell is able to influence behavior.

"Storm Drain Stenciling as part of education program. Source: http://search.ci.bothell.wa.us/documents/cd/northcreek/Overview.html.

Case Study: Chesapeake Bay Foundation Storm Drain Stenciling

Community members are involved in the process of creating signage. Such projects raise awareness of

Community members take to the streets to stencil "Don't Dump - Chesapeake Bay Drainage." Source: http://www.cbf.org/site/PageServer?pagena

the dumping problem among community members.[9]

Community Gardens

Community Gardens are a place where many of the resource management best practices are easily applicable. Often serving as a common ground in communities, community gardens are also a way to reach the entire community and simultaneously provide a place for practical application of what they have learned. Relating to waste management, the community garden is an ideal place to locate composting bins. Regarding storm water management, the community garden is a natural location to demonstrate how water is managed to prevent flooding, to filter storm water, or to harvest rainwater.

Case Study: Seattle (Washington) Tilth

Seattle Tilth is a non-profit organization that teaches organic gardening methods that include: learning to compost, improving your soil and conserving natural resources. Their programs include children's summer programs, workshops, and a Natural Lawn and Garden Hotline. Through their programs and website, people in Seattle learn to develop a greater appreciation for resource management practices.

Rebates

Rebate programs primarily serve as an incentive for best practices, but through the monetary incentive, people will also educate themselves to take advantage of these programs. Rebate programs also reduce the financial burden of installing

Photograph during one of Seattle Tilth's classes and workshops. Source: http://www.seattletilth.org/

potentially costly ways of conserving resources such as solar-panel installation, solar-powered trash compactor or rainwater harvesting systems. Rebate programs may target developers or individual residents and may include as rebates for: solar-panel installations, low-energy appliances, green roofs, rainwater harvesting systems, and solar-powered trash compactors.

Case Study: Rainwater Harvesting Rebates (Austin, Texas)[10]

The City of Austin provides a $500 rebate for installing rainwater harvesting systems of over 300 gallons. The city website provides the Rainwater Harvesting Application and lists resources to aid and educate potential rebate seekers. This program provides offsets to the initials costs of installing a rainwater harvesting system that would otherwise deter residents from investing in a system that ultimately helps them reduce their long-term water costs.

Case Study: Go Solar California![11]

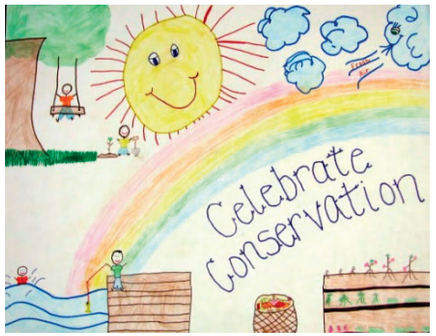
The California Solar Initiative provides economic incentives for installing solar panels and provides information for other incentives provided by other jurisdictions. The federal government provides a tax credit of up to $2,000 based on the cost of installation. Furthermore, if the energy generated by the solar panels is greater than the amount consumed by a particular unit, the additional energy is fed back into the utility grid at a rate of $2.50/watt paid by the California Solar Initiative. This strategy reduces barriers to installation of solar panels and also provides incentive for individuals to install solar panels beyond what is necessary for their residence so that they can feed energy into the grid.

Competitions

Competitions raise awareness and prove that the best management practices are achievable. In addition, competitions tend to draw media attention, another means of educating the wider public.

Case Study: National Association of Conservation Districts - Awards and Recognition Programs: National Conservation Poster Competition

This poster competition raises awareness among school-age children by considering the importance of targeting youth to teach them good habits early and to reach their families when they return home. For example, if a first grader cannot understand the word conservation, his parents will need to help him develop a poster concept, thus educating the parents in addition to the child. Furthermore, the resulting posters are compelling images that raise awareness in the larger community.



Top: 2005 Category 1 (K-1) First Place Winner, Will Moore. Bottom: 2005 Category 5 (10-12) First Place Winner, Grace Liu. Source: 2005 National Conservation Poster Contest

Case Study: Residence Challenge 2007, Ohio State University[12]

The Ohio University Facilities Management initiated a competition between residence halls to reduce energy and water consumption. The purpose was to raise awareness, cut costs, and preserve resources. The winning dorm had a cumulative water and electricity savings rate of 13.32% over the entire competition. Residents were compelled to consider their personal energy and water usage habits and how to contribute to their dormitory's performance. This program made them more aware of their consumption patterns and motivated them to develop conservation strategies, cultivating best practices among individuals.

Case Study: Harvard Green Campus Initiative – Campus Energy Reduction Program's Energy Competition[13]

Residence Challenge 2007 Logo. Source: http://www.facilities.ohiou.edu/conservation/ResidenceChallenge

Harvard buildings competed to reduce energy consumption, saving over $200,000 in utility costs over the six month competition period, and reducing greenhouse gas emissions by 868,621 lbs of carbon dioxide. The winning building was the Hoffman Lab with a 19.63% decrease. Similar to the Ohio Residence Challenge, this program helped raise awareness of the need to reduce energy consumption but also highlighted the potential savings when everyone is making an effort. Creating competition also allowed participants to see the impacts of their changed behavior with visible statistics and motivated collectively changed behavior.

Harvard University Faculty of Arts and Sciences Energy Competition Logo. Source: http://www.greencampus.harvard.edu/cerp/energycompetition.php.

Information Boards And Booklets

Information boards and booklets provide a more passive means of engaging residents and communities in resource management best practices. While these are educational materials, they do not require as much active participation. Displays can reach those who are not as proactive about learning best practices, and booklets make knowledge widely accessible.

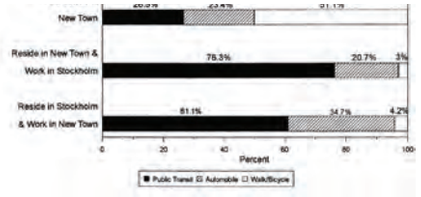
Case Study: The Texas Manual on Rainwater Harvesting[14]

The Texas Water Development Board provides a manual about system components and how to understand a rainwater harvesting system, guidelines, costs and incentives. The provision of information in a bundle makes the potential of installing such a system more accessible to individuals.

Case Study: Bus Stop Information Board, Massachusetts Bay Transit Authority

This educational poster is visible to pedestrians walking past the bus stop as well as to those waiting for

a bus to arrive. The poster provides best practices for city residents in multiple languages to target a wide population and provides pictures of recyclable papers to further elucidate the recycling process. Lastly, the poster provides a website at the bottom where passersby can find additional information on recycling in Cambridge, Massachusetts.



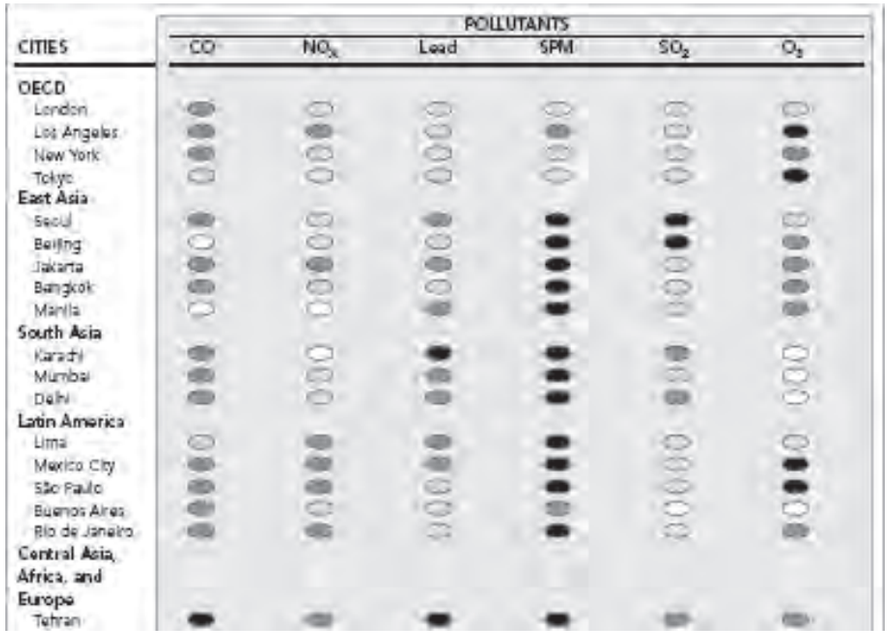
Recycling poster on side of bus stop shelter, Cambridge, MA. Source: Shutsu Chai

Technology

Technology is a tool that warrants its own series of subtools, particularly as technology is increasingly ubiquitous, growing smaller, faster, cheaper and more widely accessible. In the interest of simply providing a framework to think about the educational tools available, this section will touch on only a few of the media technologies and how they can potentially augment the learning process.

Case Study: Interactive Rainwater Harvesting System Sizing Calculator, Texas Water Development Board (TWDB)[15]

The TWDB provides an Excel spreadsheet for residents to calculate what type of rainwater harvesting system they need. This type of technology allows residents to take part in best practices and may also provide information about their potential environmental impact.



Print Screen of "Recycling" entry on Wikipedia. Source: http://en.wikipedia.org/wiki/Recycling.

Case Study: Wikipedia[16]

The world wide web allows users to access information about any topic through the user interface of Wikipedia. To provide a sample of the resources available, when "recycling" is searched in Wikipedia, a table appears on the side with the following topics: air pollution control, alternative energy, biofuel, composting, ecoforestry, energy conservation, green building, renewable energy, waste management, etc.

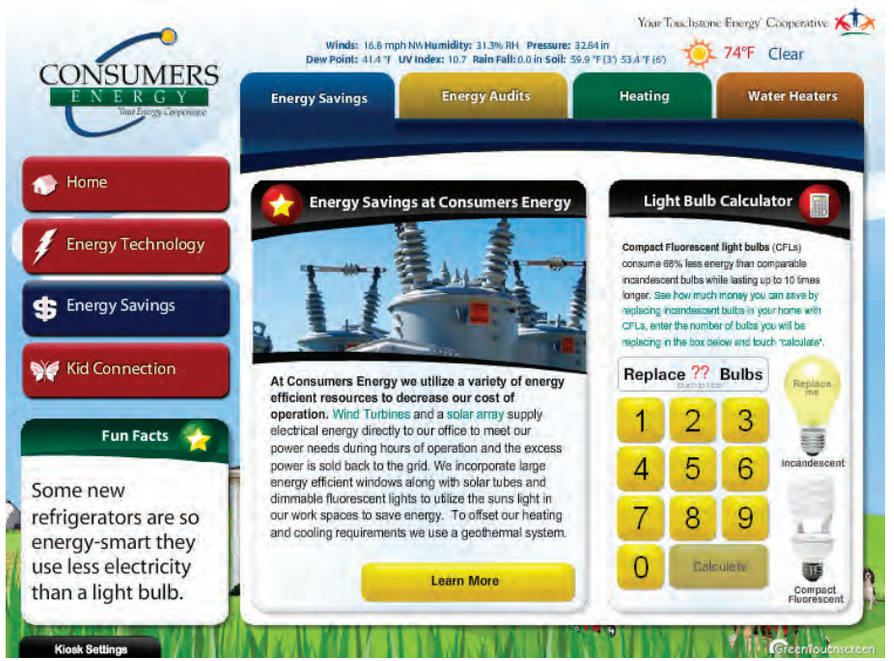
Wikipedia is only one example of the usefulness of a wiki, a collaborative website that can be edited by any user without restriction. These web spaces can be rich compilations of knowledge from a wide variety of sources and allow users to input their own knowledge. This will be particularly useful in providing information about best practices as they evolve as well as providing a useful interface for residents to teach one another. Ultimately, a wiki can provide a virtual community through which information about best practices can be shared.

Case Study: The PLAZmA Digital Gallery, MIT School of Architecture and Planning[17]

These ever changing screens allow a wide variety of programming from posters to educational videos. This technology and its flexibility enable a wide range of practices to be displayed targeting a wider range of audiences.

Case Study: The Green Touchscreen

The Green Touchscreen is an example of a technology-enhanced community board. These kiosks are placed around buildings to provide information to users. Consumers Energy provides



Screen capture of Green Touchscreen kiosk at Consumers Energy. Source: http://consumersenergy.greentouchscreen.com/.

information about energy technology and energy savings to those who use the kiosk. Furthermore, the kiosk provide a user interface for children and "Fun Facts" to teach energy facts. These kiosks are internet dependent and can be displayed in many locations with only hardware costs.[18] They can be useful for information dissemination, and the interactive nature of this system allows flexible links to simultaneously target different age groups or populations.

What Research Is Already There? And What Is Needed?

Art, Maine College of. "Long Overdue: Book Renewal." In *Altered Book*, http://www.meca.edu/Meca_Galleries/Altered_Book.aspx. (accessed April 28, 2007).

186 books from the Portland Public Library in Maine were transformed into new works of art. This website includes images of several of these books.

Austin City Connection. 1995. "Rainwater Harvesting Rebates." In *Water Conservation*, City of Austin, Texas, http://www.ci.austin.tx.us/watercon/rwrebates.htm. (accessed April 11, 2007).

Website for Austin, Texas provides information and forms for rainwater harvesting systems, rebates and applications for use by their residents.

California Energy Commission. 2007. "Cash Back for Solar on Your Home." In *Go Solar California!*, Energy Commission Media & Public Communications Office, http://www.gosolarcalifornia.ca.gov/csi/cash_back.html. (accessed April 24, 2007).

Website provides information about rebates for installations of solar panels on residences. Links on website include other solar energy programs.

PLAZmA Screen at MIT Steam Café. Source: Shutsu Chai.

References

Chai, Shutsu. *Bus Shelter Recycling Poster by the Works of Cambridge*. Cambridge, 2007. Photograph.

Photograph of a poster on paper recycling practices in multiple languages. Posted on the side of a bus shelter on Massachusetts Avenue near the Massachusetts Institute of Technology.

Chai, Shutsu. *Plazma Screen in Steam Cafe at Mit*. Cambridge, 2007.

Photograph of a MIT Plazma screen that displays ever changing programs and information.

Chesapeake Bay Foundation. 2007. "Take Action: Storm Drain Stenciling." http://www.cbf.org/site/PageServer?pagename=action_outdoors_stencil. (accessed April 11, 2007).

Website provides information about how to participate in storm drain stenciling for the Chesapeake Bay. Detailed instructions included.

City of Bothell. "Project Overview." In *North Creek: Bothell's Urban Treasure*, http://search.ci.bothell.wa.us/documents/cd/northcreek/Overview.html. (accessed April 28, 2007).

Website describes project for cleaning up Bothell's North Creek, including a storm drain photo.

Environmental Campaigns. "Community Benefits." In *Eco-Schools*, http://www.eco-schools.org.uk/why/community-benefits.htm. (accessed April 11, 2007).

Website describes the potential impacts of an "eco-school" type education on children and communities.

Gee, Pat. "Sneakers Will Be Recycled as Play Areas." *Honolulu Star Bulletin*, April 6 2007.

Article describes Nike's Reuse-A-Shoe program and its past success in Honolulu schools.

Global Inheritance. "Trashed :: Art of Recycling." http://www.globalinheritance.org/trashed/. (accessed April 11, 2007).

Website describes the "TRASHed" program for decorating recycling and trash bins. Past programs are listed with links to sample decorated trash cans and events.

Green Touchscreen. "Green Touchscreen Web Enabled." (accessed April 28, 2007).

Website provides greater detail about Green Touchscreen kiosks and how they function in building spaces.

Links provide demonstration kiosks and the potential of these kiosks.

Green Touchscreen. "Your Energy Savings at Consumers Energy." In *Consumers Energy*, http://consumersenergy.greentouchscreen.com/. (accessed April 28, 2007).

Website provides the information interface that is provided at kiosks at Consumers Energy. Information on website include energy technology and energy savings information. Website also includes a interactive website for kids.

Harvard Green Campus Initiative. 2007. "Faculty of Arts and Sciences Energy Competition." In *Campus Energy Reduction Program*, http://www.greencampus.harvard.edu/cerp/energycompetition.php. (accessed April 11, 2007).

Website describing the results of

Harvard's energy competition from September 20-March 20. Winner reduced energy consumption by 19.63%. Competition results and data included.

Keagy, Keolo. "The Plazma Digital Gallery." Massachusetts Institute of Technology, http://sap.mit.edu/resources/galleries/plazma_digital_gallery/. (accessed April 28, 2007).

Website describes the use of MIT's Plazma Digital Gallery and how to have work displayed as part of its programming.

Liu, Grace. *2005 National Conservation Poster Contest: Living a Legacy... Leaving a Legacy*. Washington: National Association of Conservation Districts, 2005. Drawing.

Poster of first-place student entry for the 10th through 12th grade category of the poster competition to raise awareness for resource conservation.

Maryland Association for Environmental & Outdoor Education. "Program Overview." In *Green School Program*, http://www.maeoe.org/greenschool/overview.html. (accessed April 11, 2007).

Website describes the Maryland Green Schools Program and provides links with resources about how to participate in this particular program.

Moore, Will. *2005 National Conservation Poster Contest: Living a Legacy... Leaving a Legacy*. Washington: National Association of Conservation Districts, 2005. Drawing.

Poster of first-place student entry for the kindergarten through 1st grade category of the poster competition to raise awareness for resource conservation.

Nike. "Reuse-a-Shoe: Surface Donations." In *Nikebiz: Environment*, http://www.nike.com/nikebiz/nikebiz.jhtml?page=27&cat=reuseashoe&subcat=us-surface. (accessed April 11, 2007).

Website provides information about surface donations and how reused shoe surfaces have been used. Links describe the program in greater detail and the process of recycling and reusing shoes.

Ohio University Office of Resource Conservation. 2007. "Residence Challenge 2007." Ohio University, http://www.facilities.ohiou.edu/conservation/ResidenceChallenge2007.htm. (accessed April 12, 2007).

Website describing Ohio University's residence hall competition to reduce energy and water consumption. Program details and results included.

Seattle Tilth. "Conserve Natural Resources." http://www.seattletilth.org/resources/conserve. (accessed April 11, 2007).

Website provides suggestions and strategies for conserving natural resources. Links include general gardening resources and programs that encourage community gardening.

Shibley, Robert, Emily Axelrod, Jay Farbstein, Richard Wener. "Silver Metal Winner: The Heidelberg Project." In *Reinventing Downtown: 2005 Rudy Bruner Award for Urban Excellence*: Bruner Foundation, Inc., 2005.

Book provides detailed case studies of the winners of the Rudy Bruner Awards from 2005. This section describes the Heidelberg project

where the artist has reused many items from the Detroit area to create a sort of art for the neighborhood.

Sutherland, Amy. "Wear This Book (but Bring It Back Friday)." *The New York Times*, April 23 2006, 30.

Article describes the Portland Public Library and the Maine College of Art program to turn unloanable books into art.

Texas Water Development Board. 2005. "The Texas Manual on Rainwater Harvesting." 3rd Edition, http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual_3rdedition.pdf. (accessed April 11, 2007).

Manual addresses rainwater harvesting system components, water quality and treatment, water balance and system sizing, cost estimation and rainwater harvesting guidelines.

Transportation Water Development Board. "Interactive Rainwater Harvesting System Sizing Calculator." In *Rainwater Harvesting*, http://www.twdb.state.tx.us/assistance/conservation/Alternative_Technologies/Rainwater_Harvesting/RWHSystemSizingCalculator.xls. (accessed April 11, 2007).

Excel spreadsheet to calculate size of rainwater harvesting system for Texas residents.

Wikipedia. "Recycling." http://en.wikipedia.org/wiki/Recycling. (accessed April 11, 2007).

Wikipedia article describing recycling with links to relevant topics.

Endnotes

1. Interview with Wonderland resident. Resident noted that school-age children do not need more outdoor recreational space as it is generally dark or too late for them to go out and play by the time they return from school.

2. Environmental Campaigns, Community Benefits ([cited April 11 2007]); available from http://www.eco-schools.org.uk/why/community-benefits.htm.

3. Maryland Association for Environmental & Outdoor Education, Program Overview (February 20, 2007 [cited April 11 2007]); available from http://www.maeoe.org/greenschool/overview.html.

4. Global Inheritance, Trashed :: Art of Recycling ([cited April 11 2007]); available from http://www.globalinheritance.org/trashed/.

5. Amy Sutherland, "Wear This Book (but Bring It Back Friday)," The New York Times, April 23 2006.

6. Robert Shibley, Emily Axelrod, Jay Farbstein, Richard Wener, "Silver Metal Winner: The Heidelberg Project," in Reinventing Downtown: 2005 Rudy Bruner Award for Urban Excellence (Bruner Foundation, Inc., 2005).

7. Pat Gee, "Sneakers Will Be Recycled as Play Areas," Honolulu Star Bulletin, April 6 2007.

8. City of Bothell, Project Overview ([cited April 28 2007]); available from http://search.ci.bothell.wa.us/documents/cd/northcreek/Overview.html.

9. Chesapeake Bay Foundation, Take Action: Storm Drain Stenciling (2007 [cited April 11 2007]); available from http://www.cbf.org/site/PageServer?pagename=action_outdoors_stencil.

10. Austin City Connection, Rainwater Harvesting Rebates (City of Austin, Texas, April 28, 2007 1995 [cited April 11 2007]); available from http://www.ci.austin.tx.us/watercon/rwrebates.htm.

11. California Energy Commission, Cash Back for Solar on Your Home (Energy Commission Media & Public Communications Office, 2007 [cited April 24 2007]); available from http://www.gosolarcalifornia.ca.gov/csi/cash_back.html.

12. Ohio University Office of Resource Conservation, Residence Challenge 2007 (Ohio University, 2007 [cited April 12 2007]); available from http://www.facilities.ohiou.edu/conservation/ResidenceChallenge2007.htm.

13. Harvard Green Campus Initiative, Faculty of Arts and Sciences Energy Competition (2007 [cited April 11 2007]); available from http://www.greencampus.harvard.edu/cerp/energycompetition.php.

14. Texas Water Development Board, The Texas Manual on Rainwater Harvesting (3rd Edition) [PDF] (2005 [cited April 11 2007]); available from http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual_3rdedition.pdf.

15. Transportation Water Development Board, Interactive Rainwater Harvesting System Sizing Calculator ([cited April 11 2007]); available from http://www.twdb.state.tx.us/assistance/conservation/Alternative_Technologies/Rainwater_Harvesting/RWHSystemSizingCalculator.xls.

16. Wikipedia, Recycling ([cited April 11 2007]); available from http://en.wikipedia.org/wiki/Recycling.

17. Keolo Keagy, The Plazma Digital Gallery (Massachusetts Institute of Technology, [cited April 28 2007]); available from http://sap.mit.edu/resources/galleries/plazma_digital_gallery/.

18. Green Touchscreen, Green Touchscreen Web Enabled ([cited April 28 2007]).

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
77 Massachusetts Ave. Cambridge MA 02139

http://www.mit.edu shenzhen.mit.edu