

10 Principles for Liveable High-Density Cities

Lessons from Singapore



Singapore

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Foreword

Chief Executive Officer Urban Land Institute

A major focus for the Urban Land Institute is rethinking urban development for the 21st century. We're looking closely at the economic, social, and environmental issues that are changing the business of city building, contemplating the ramifications for both the land use industry and our cities.

Among the many factors influencing the built environment are restructured capital markets; changing energy costs; population and demographic shifts; changing housing needs; and advances in technology. These are issues that are both local and global in impact, and they will be with us through both recessions and boom times. What, where, and how we build to accommodate these changes will distinguish the successful cities from those that struggle.

However, perhaps the single most important agent of change is rapid urbanization, a global-scale trend resulting in the majority of the world's population now living in urban areas. Urbanization this expansive and pervasive is a reflection of new economic drivers, and it is presenting challenges for the industry in building cities that are prosperous, liveable, and resilient.

Through *10 Principles for Liveable, High-Density Cities: Lessons from Singapore*, the Urban Land Institute (ULI) and the Center for Liveable Cities (CLC) are showing how Singapore has turned the challenges of rapid urbanization into opportunities, creating an appealing living and working environment. The projects cited in the report represent the type of progressive, transformative development for the 21st century that results from visionary thinking. Each principle is applicable to cities around the world, whether they are established markets being redeveloped, or emerging ones being developed.

The report represents an exciting, productive, and collaborative effort between ULI and the CLC. We very proud to be partners with an organization that shares ULI's deep commitment to creating vibrant, liveable communities that are cherished for generations.

For more than 75 years, ULI has continuously expanded its network for sharing knowledge and information for the benefit of our industry and our cities. Our work with the CLC is allowing us to learn from private- and public-sector professionals who are working to make our cities better. I have high hopes for what we will accomplish together.

Patrick L. Phillips
Chief Executive Officer
Urban Land Institute

Foreword

Minister for National Development Singapore

The city is and will be home for more and more people. The inexorable trend of urban population growth in modern times is not likely to stop. Even for countries with no shortage of land, the growth of their urban populations have confronted their cities with constant challenges to the quality of their living environment. Overcrowding in poorly designed high-density dwellings, traffic congestion and grid-locks during peak hours, pollution and poor public hygiene, social violence and inner-city crime are some of the typical aspects of city life when Governments and their planners fail to effectively address the challenges of developing the modern city.

For Singapore, these challenges have been compounded by the limitations of its size as a small island. For us, planning and creating a liveable high-density city in a land area of just over 700 square kilometres is not a nice-to-have but a matter of survival because we are a sovereign city-state. Maintaining a good quality, liveable high-density urban landscape in which all Singaporeans can find and make a home is crucial to the survival of the Singapore nation.

Indeed Singapore's former Prime Minister Mr Lee Kuan Yew observed in an interview with the Centre for Liveable Cities that a good city is one that is clean, creates a sense of safety and space, provides mobility and connectivity, and above all, *"a sense of equity, that everybody owns a part of the city."*

Singaporeans are justly proud of what has been achieved. But we also know how much of that journey has benefitted from the invaluable experiences and lessons—both good and bad—that others have taught us. And today we continue to learn so much from hosting the World Cities Summit when urban leaders, planners and practitioners gather to freely exchange their insights, experiences and best practices.

It is in this spirit that this book is written. This is not a how-to book by Singapore on how to create a liveable city; it is a how Singapore has so far done it book. It is our hope that urban practitioners elsewhere will find our ideas and experience on city-making over the past few decades useful and that they may in turn evolve and improve upon them in the contexts of their own cities, so that their people may also find good homes to live and to prosper.

Khaw Boon Wan
Minister for National Development
Singapore



Contents

8	Introduction
	10 Principles for Liveable High-Density Cities: Lessons from Singapore
13	Principle One: Plan for Long-Term Growth and Renewal
19	Principle Two: Embrace Diversity, Foster Inclusiveness
25	Principle Three: Draw Nature Closer to People
31	Principle Four: Develop Affordable Mixed-Use Neighbourhoods
35	Principle Five: Make Public Spaces Work Harder



41	Principle Six:	Prioritise Green Transport and Building Options
47	Principle Seven:	Relieve Density with Variety and Add Green Boundaries
53	Principle Eight:	Activate Spaces for Greater Safety
57	Principle Nine:	Promote Innovative and Nonconventional Solutions
63	Principle Ten:	Forge 3P Partnerships
68	Challenges and Conclusion	
69	Appendix	

About ULI

The Urban Land Institute is a 501(c)(3) nonprofit research and education organization supported by its members. Founded in 1936, the Institute now has nearly 30,000 members worldwide representing the entire spectrum of land use and real estate development disciplines, working in private enterprise and public service. As the preeminent, multidisciplinary real estate forum, ULI facilitates the open exchange of ideas, information, and experience among local, national, and international industry leaders and policy makers dedicated to creating better places.

The mission of the Urban Land Institute is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI is committed to bringing together leaders from across the fields of real estate and land use policy to exchange best practices and serve community needs by:

- Fostering collaboration within and beyond ULI's membership through mentoring, dialogue, and problem-solving.
- Exploring issues of urbanization, conservation, regeneration, land use, capital formation, and sustainable development.
- Advancing land use policies and design practices that respect the uniqueness of both built and natural environments.
- Sharing knowledge through education, applied research, publishing, and electronic media.
- Sustaining a diverse global network of local practice and advisory efforts that address current and future challenges.

About the ULI Foundation

The ULI Foundation is the philanthropic partner of the Urban Land Institute, providing an assured source of funding for ULI's core research, education, and public service activities. Through its various giving programs, the Foundation helps strengthen ULI's ability to provide leadership in the responsible use of land to enhance the total environment. Under the 75th Anniversary Urban Innovation fund, the ULI Singapore District Council and CLC were awarded an Urban Innovations Grant to undertake a joint research initiative focused on issues of "High-density & High Liveability" and lessons learned in the Singapore context.

About ULI Asia Pacific

Across Asia Pacific and Japan, the Institute has nearly 1,000 members, with a particularly strong presence in Japan, Greater China, Southeast Asia, and Australia. The regional office is headquartered in Hong Kong, with satellite offices in Tokyo and Singapore. ULI AP brings together industry leaders with a common commitment to improving professional standards, seeking the best use of land, and following excellent practices. By engaging experts from various disciplines, the Institute can arrive at responsible answers to problems that would be difficult to achieve independently. ULI AP shares its knowledge through various discussion forums, research, publications, and electronic media. ULI's activities in the region are aimed at providing information that is practical, down-to-earth, and useful so that on-the-ground changes can be made. By building and sustaining a diverse network of local experts in the region, the Institute is able to address the current and future challenges facing Asia's cities.



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About CLC

Vision: A leading knowledge centre for liveable and sustainable cities

The Centre for Liveable Cities (CLC) was set up in 2008 based on a strategic blueprint developed by Singapore's Inter-Ministerial Committee on Sustainable Development. The Centre's mission is to distil, create and share knowledge on liveable and sustainable cities. CLC distils key learning points from Singapore's experiences over the last half-century, while creating knowledge to address emerging challenges. It also shares knowledge with, and learns from, other cities and experts.

CLC receives guidance from its Advisory Board, comprising senior figures from academia, industry and the public sector. A high-level panel of Distinguished Advisors - comprising prominent former politicians and senior civil servants - contributes to the intellectual development of the Centre. CLC works closely with its Stakeholder Agencies - representing Singapore's urban planning, governance and development expertise - to integrate their knowledge. CLC Experts are domain experts with technical knowledge and expertise that CLC will tap for future consultancy projects. The Centre operates as part of the Ministry of National Development, and comprises a dynamic CLC Team of officers from diverse disciplines and backgrounds. Guided by the CLC Framework for Liveable and Sustainable Cities, the Centre works across three main areas - Research, Training, and Promotions.

Research is central to the Centre's work, and is conducted in close collaboration with local and international partners. CLC's research activities include its Integrated Urban Solutions Research, and Research Workshops, as well as Urban Systems Studies. The Centre develops print and digital Publications for global audiences, to share its research as

well as the knowledge of its partners, through such titles as the Singapore Urban Systems Studies booklet series, the biannual *Urban Solutions* magazine, as well as the monthly CLC e-Newsletter.

Training is a key arm of the Centre's activities, as it aims to draw on its research to become a leading academy for cities. CLC's flagship training initiative is its Leaders in Urban Governance Programme for local public servants, as well as the Temasek Foundation Leaders in Urban Governance Programme, which is aimed at international city leaders.

Promotion refers to the Centre's efforts to collaborate with partners to share knowledge, particularly through Events. CLC is a co-organiser of the World Cities Summit - the global platform for government leaders and industry experts to address liveable and sustainable city challenges, share innovative urban projects and forge partnerships. CLC also co-organises the World Cities Summit Mayors Forum, and the Lee Kuan Yew World City Prize. The regular CLC Lecture Series is another platform for thought leaders and experts to exchange ideas and share knowledge. Supporting these efforts, CLC forges strategic Partnerships with local and international experts and organisations.

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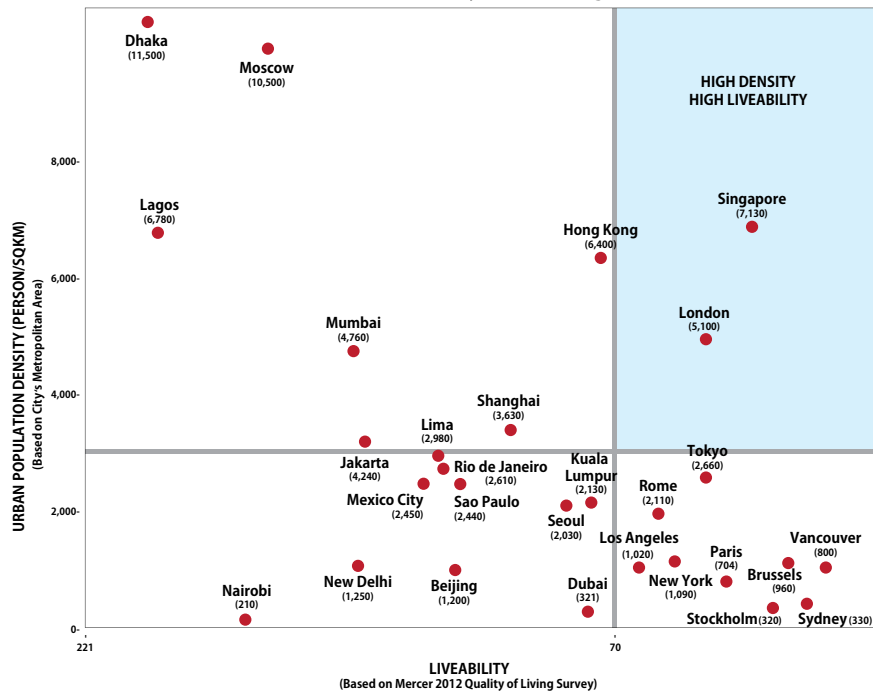
Introduction

Nearly 70 per cent of the world's population is expected to live in urban areas by 2050. According to UN-HABITAT, cities are already home to half of humankind. More than 400 cities worldwide now have a population exceeding 1 million. The number of megacities—those with a population of more than 10 million—is on the rise.ⁱ

Cities are becoming denser—a trend particularly evident in Asia. Not only are people moving to cities from the countryside and outlying areas seeking economic opportunity, but they are also moving to other countries in order to live in the global cities of the world. Many of the key cities in Asia have population densities of 2,000 to 12,000ⁱⁱ persons per square kilometre—among them Tokyo, Shanghai, Mumbai, and Singapore.

A general sentiment exists that high density spells the end for liveability in a city. Density is often blamed for accentuating problems like overcrowding, crime, disease, pollution, poverty, and high living costs. The often-reported negative impacts of high-density living, such as a congested cityscape, low-quality urban services, increasing competition among people for use of facilities, and associated social conflicts, create a pessimistic view of life in a compact, highly built-up city. The results of some international surveys—for example, the Global Liveability Survey by the Economist Intelligence Unit (EIU), Mercer's Quality of Living Survey, and Siemens's Asian Green City Index—have added to the perception that liveability tends to be higher for cities that have a larger geographic space, low-rise developments, and a low-density population. In the EIU survey, which uses metrics on health care, culture and environment, education, and infrastructure, seven of the cities with the highest score for liveability are in Australia and Canada. Two of those cities are Melbourne and Vancouver, with population densities of 540ⁱⁱⁱ and 802^{iv} persons per square kilometre, respectively. Elsewhere in the top ten are Auckland, with a density of 382^v persons per square kilometre, and Helsinki, with a density of 2,800.^{vi}

The CLC Liveability Matrix Diagram



But a densely populated city does not have to submit to a grim fate. If it is well thought out and planned, the city can offer its residents a very high quality of life. In fact, in the best case, the city can use its density to its advantage. Economists studying cities routinely find, after controlling for other variables, that workers in denser places earn higher wages and are more productive. American economists like Paul Romer and Edward Glaeser have proposed a link between density and a city's capacity for innovation. In addition, dense cities which are well planned are sustainable cities. Studies show that a doubling of density results in a 30 per cent reduction in energy use per capita.^{vii} The lower-density cities of the United States (typically ten persons per hectare or less) use about five times more energy per capita in gasoline than the cities of Europe, which are in turn about five times denser on average.^{viii} A compact city with good public transport, walkability, and a reduced need to drive long distances to reach destinations adds to environmental sustainability.

With cities likely to get denser in the coming decades^{ix}, it is important to consider how best to mitigate the stresses caused by density and take advantage of the opportunities it creates.

It was with this in mind that the Centre for Liveable Cities (CLC) Singapore and the Urban Land Institute (ULI)

initiated a collaborative project to find examples of how liveability and sustainability correlate with a city's highly dense environment^x.

This project is based on Singapore's urbanisation experience. Despite having a population density of over 7,000 persons per square kilometre, Singapore has been consistently highly ranked in many liveability surveys, including Mercer's 2010 Quality of Living Survey and Siemens's Asian Green City Index. This project has focussed on understanding and distilling principles that have resulted in Singapore's unique combination of a highly dense yet highly liveable urban environment.

PROJECT CASE STUDIES AND WORKSHOPS

The ten CLC/ULI Principles for Liveable High-Density Cities are based on assessments of Singapore's highly dense and liveable districts and on findings from two joint workshops. A brief on the case studies and the workshop is presented in the following section; details are provided in annex 1 and 2.

Case Studies

CLC and ULI identified four distinct districts in Singapore that would constitute highly dense and highly liveable spaces—the mixed-use downtown district of Marina Bay, the commercial corridor of Orchard

Road, and two new high-quality and affordable public housing hubs, Toa Payoh and Tampines. The CLC/ULI team studied the origins, development cycle, and planning framework of these four districts to identify success factors, issues, and solutions implemented.

Workshops

Two joint CLC/ULI workshops were held in Singapore in the first half of 2012, bringing together more than 62 thought leaders, experts, and practitioners from disciplines related to urban planning and development and representing both the private and public sectors. Participants discussed factors that contribute to the liveability of a highly dense city.

Workshop I

At the first workshop, held in March, the discussions focussed on the four case study districts. Three breakout groups brainstormed on the factors that contribute to the three "liveability outcomes"—a competitive economy, a sustainable environment, and a high quality of life. An important element of Singapore's success has been its ability to keep focussed on these outcomes even while development was happening rapidly.

Each group was assigned one liveability outcome as the focal point for its discussion on the following questions:

- Which initiatives described in the four cases have contributed to the particular outcome?
- How does high density contribute in terms of benefitting or challenging the particular outcome?
- How would the outcome be affected if density were increased?

The workshop came up with an initial set of 24 principles for creating a high-density, highly liveable city.

Workshop II

The main purpose of the second workshop, held in May 2012, was to corroborate, consolidate, and further develop the 24 principles gleaned from the first workshop. The

discussion questions were meant to help participants deliberate on the proposed principles based on their own experiences and expertise. The participants were divided into eight groups, and each group discussed two focus areas:

- Conditions and prerequisites that enable high-density environments to also become highly liveable and sustainable; and
- Refinement of the set 24 principles.

The workshop participants also looked at the challenges and conditions that would affect the applicability and relevance of these principles. The workshop then condensed the 24 principles into ten and proposed that the findings of the study be made into a report.

Each of the CLC/ULI Ten Principles for Liveable High-Density Cities contained in this publication is accompanied by examples illustrating how Singapore embodied aspects of that principle, as well as a brief listing of some of the key related programmes and policies. For their wider applicability, each principle is also supported with a section that highlights the possible strategy, action points, and likely outcomes and challenges related to the principle.

CLC and ULI hope that in showing how the application of these principles has led to a higher quality of life in Singapore, this report will contribute in some way towards people having a more optimistic view of life in high-density cities

Notes

- i. Ng 2010.
- ii. The population density range is arrived at by comparing the population densities of the metropolitan regions of Asian cities such as Beijing, Shanghai, Mumbai, Osaka, Tokyo, Dhaka, and others. Metropolitan-area data were used consistently for all cities. As defined in the U.N. report, World Urbanization Prospects, the 2009 Revision, a metropolitan area is a contiguous area encompassing the city proper and additional surrounding areas that are under the direct influence of the city proper (for instance, through transport links and a commuting labour market). With cities now growing beyond their political boundaries into larger metropolitan

areas, as noted in the EIU Hot Spots report, metropolitan area definitions were thought to be more relevant.

- iii. Australian Bureau of Statistics 2011.
- iv. Statistics Canada 2011.
- v. New Zealand Transport Agency 2008.
- vi. City of Helsinki website, 2012, <http://www.helsinki.fi/hki/Helsinki/en/Information+on+Helsinki>.
- vii. Holtzclaw 1997.
- viii. Kenworthy and Laube 1999.
- ix. According to U.N. projections, about 70 per cent of the world population will be urban by 2050. The McKinsey study "Global Cities of the Future," in 2012 estimated that by 2025, 136 new cities—all from the developing world—will rank among the top 600 in gross domestic product.
- x. The notion of high density is a matter of perception—subjective and dependent on the society or individual's judgement against specific norms. Hence, societies or individuals of different backgrounds and in different contexts come up with different definitions of high density. For the purposes of an objective study, high density has been defined here as the upper quarter of the 221 cities surveyed in the Mercer's Quality of Life index.

Study Methodology

1. Establishment of a steering committee.
2. Analysis of the impacts of density within the "Urban Systems" of a Liveable & Sustainable City, namely "Environment", "Economy" and "Society". (Some factors that can be looked at include wages, competitiveness under Economy; social network, time spent with family under Society; and water management, transport, energy efficiency, environmental planning [including greenery], waste management, etc., under Environment).
3. Identification of 5–10 key factors under Urban Systems that are positively co-related with increasing density.
4. Analyze the necessary conditions and systems (Strong Urban Governance and Integrated & Long-Term Master Planning) that allow a high-density environment to bring about high liveability and sustainability.
5. Organize a ULI/ CLC workshop with multiple stakeholders.
6. Hold a variety of working meetings with various stakeholders.
7. Formulate preliminary principles related to high density and urban livability.
8. Organize a 2nd workshop with multiple stakeholders to review the principles, group into categories, and shortlist recommendations.
9. Organize a review panel and develop a summary report.
10. Launch the final report.

Singapore by Numbers



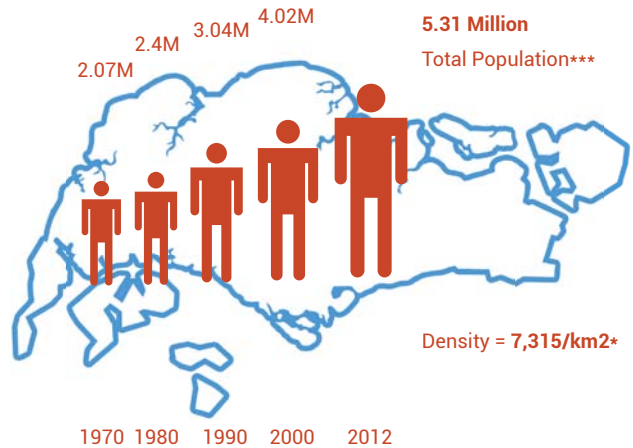
World Location



Regional Location



Area



Population



GDP



Total Building Footprint Percentage



Total Built-up Space Percentage



Total Green Surface Area Percentage

Sources:

* 1000 Singapore: A model of the compact city

** International Monetary Fund. Retrieved 21 April 2012.

*** Time Series on Population (Mid-Year Estimates). <http://www.singstat.gov.sg>



The different "urban layers" of redevelopment in the Tanjong Pagar district - conserved shophouses, public housing and business offices. Photo courtesy of William Cho.

01

Plan for Long-Term Growth and Renewal

A highly dense city usually does not have much choice but to make efficient use of every square inch of its scarce land. Yet city planners need to do this in a way that does not make the city feel cramped and unliveable.

Singapore, with over 5 million people perched on 710 square kilometres of land, has always worked to strike this balance. The city has gone to great lengths to manage the demand and supply of land for present and future needs. Singapore's urban planners do not view a planning time horizon of 50 years as too long; they look at development as well as redevelopment. A combination of long-term planning, responsive land policies, development control, and good design has enabled the city to have dense developments that do not feel overly crowded, and in fact, are both functional and aesthetically pleasing.



The Marina Bay Business Center is one of the projects under "white-site" land use zone. Photo courtesy of William Cho.

Planning for Long-Term Growth

City planning in Singapore is shaped by the long-term Concept Plan, a strategic land use and transportation plan that guides the overall land use strategy over a 40- to 50-year period. The Master Plan then translates the strategies of the Concept Plan into more detailed plans to guide development over a ten- to 15-year time frame. Development controls are put in place to ensure that the city develops according to the prescribed land use and intensity spelt out in the Master Plan.

The Land Transport Authority also safeguards land for infrastructure through the "road reserves/line" plan. Portions of land are identified and set aside for future development or redevelopment. This means infrastructure can be built as needed, with minimal easement problems.

While these plans are for the medium to long term, they are not rigid; they are reviewed periodically to ensure that they remain relevant as conditions change. This eye on flexibility is an important hallmark of long-term planning in Singapore. For instance, the government safeguards land for

the future through its sale of lease tenures. However, in the case of commercial and industrial use, the tenure is intentionally short, often 30 years or less (compared to 99 years or more for residential use), giving the government the flexibility to periodically review land use and plan for redevelopment.

Singapore's land policies also aim to create value for the land. The government has designated some "white sites" where developers can propose the land use for such development parcels provided they achieve a minimal mix of uses. Marina Bay is a good example of white-site zoning that has given developers flexibility to match changing market demands, thereby encouraging investment in development that moves in tandem with the city's economic growth and sustaining the city's competitiveness. Land parcels owned and developed by public agencies are valued at market price in order to preserve the long-term value of the sites and encourage development and redevelopment.

Planning for Change and Renewal

Singapore's land policies enable change and renewal of existing developments. Public housing is a good example. Old public housing apartment blocks are systematically upgraded through programmes such as the Main Upgrading Programme and the Home Upgrading Programme. Upgrades can include amenities such as new lifts or improvements to the precinct through the addition of neighbourhood centres. Another programme, the Selective En Bloc Redevelopment Scheme, identifies older blocks of public housing with good redevelopment potential. So as not to compromise the existing communities built up over time, affected residents, when possible, are generally offered new homes nearby or given priority in relocation back to the new developments.

Policies and Programmes

Examples

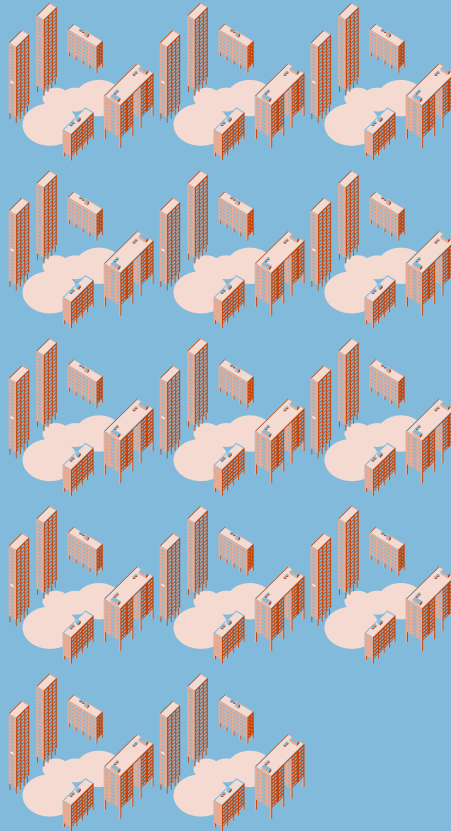
- The Urban Redevelopment Authority uses planning tools such as the Concept Plan, the Master Plan, and the Development Guide Plans as well as the Government Land Sales Programme to guide long-, medium- and short-term growth and development.
- The Housing Upgrading and Estate Renewal programmes, as well as tools such as “white sites” and flexible land tenures, have enabled systematic urban renewal. For instance, the Housing Development Board’s Selective En bloc Redevelopment Scheme has helped rejuvenate older estates by building new and higher-density developments on sites vacated by the old blocks.

S\$3.3bn

worth of investment for Main Upgrading Program (MUP) benefitting 130,000 households over 22 years.¹

14

precincts (10,000-12,000 households) benefitting from Home Improvement Programs (HIP).²



S\$5.5bn

worth of investment for Lift Upgrading Program (LUP) benefitting some 500,000 families.³

Sources:

1. Channelnewsasia.(2012).HDB's Main Upgrading Programme ends. Retrieved from <http://www.channelnewsasia.com>
2. About Singapore Property ,(2010). 14 HDB precincts selected each year for sprucing up. Retrieved from <http://aboutsingaporeproperty.blogspot.sg>
3. 50 Years Of Public Housing In Singapore. (2011). Retrieved from <http://www.earoph.info/pdf/2011papers/2011-PAPER7.pdf>

Strategy

- City planners should have a medium- to long-term planning horizon, but also should factor in mechanisms, such as regular reviews, to allow flexibility to adjust the plan as conditions change. They also should put in place development controls to ensure that the plans are followed and to prevent unwanted building bulk in an already dense city. This is very important for creation of infrastructure corridors that can accommodate long-term growth and flexibility.

Actions

- Safeguard certain parcels of land for future developments, including parcels to accommodate infrastructure growth addressed in the city’s urban master plan.
- Identify existing developments that can be upgraded or redeveloped to maintain their liveability and economic value.
- Review the long-term land use plan regularly.

Outcomes

- Balanced development in the city leading a pleasant living environment
- Physical space developed in line with economic growth trends.
- Land value maintained or increased.

Challenges

- Volatility in the economy and population and demographic changes create difficulty in tying long-term growth plans to short- and medium-term objectives.
- Aligning local community interests with the city government’s development objectives and plans can prove difficult.

Stages of Growth and Renewal

Several components of urban growth in Singapore were prioritised and implemented at different stages of the city's development.

Underground utility lines ensured that the provision of water, electrical and telecommunication services were secure and coordinated. These are also easier to maintain and do not create a disruption at the street level whenever repairs and routine maintenance are needed.

Part of New Town Planning measure is to create high-density residential precincts made up of high-rise public housing buildings. Besides having efficient land use, these precincts also allow shared facilities that are more accessible. In densely populated estates, there is a fundamental need to promote neighbourliness, harmony and cohesiveness among residents of diverse backgrounds and interests. Community centres in the various neighbourhoods facilitate social, cultural and recreational interactions within the community and also serve as a respite from the high-density buildings around it.

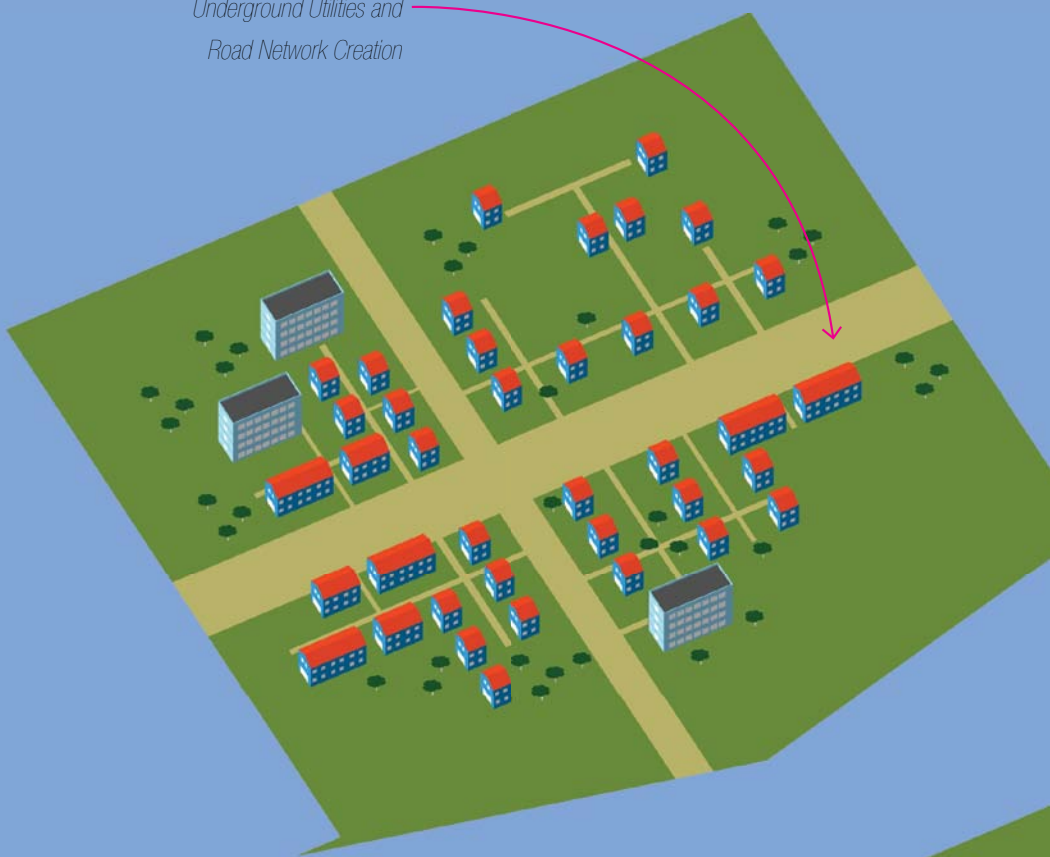
A fully integrated network of pedestrian links and commercial entities at transit centres help people move about more comfortably, encourage social interaction, as well as promote the use of public transport.

Leveraging on public mass transit developments, key mixed-use nodes were established to enhance the town's social and economic vibrancy.

"White sites" were demarcated to make key developments more competitive. These "white" sites allow developers to respond to changing market conditions and adapt the development project without having to pay an additional land premium, as long as the project is still in line with the allowable uses for the site. Great care has been given to preserving and improving green public open spaces.

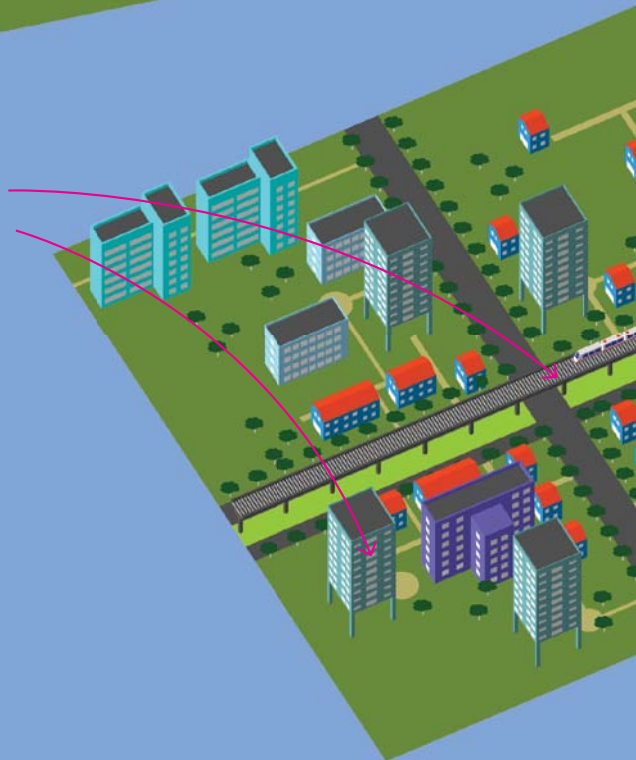
Public Infrastructure Development

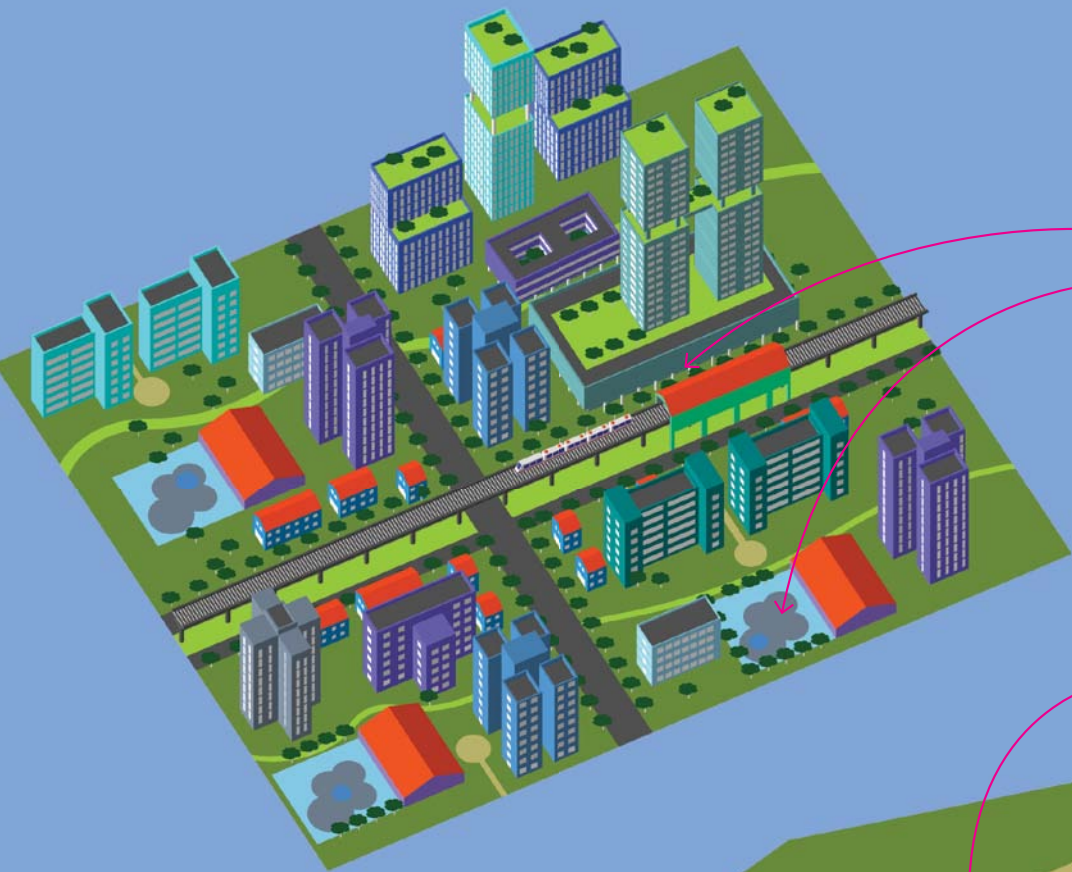
Underground Utilities and Road Network Creation



Public Housing Development

*Public Mass Transit Creation
Public Housing Clustering*





***Integrated Mass Transit,
Commercial and Residential
Development***

Integrated Commercial and Transit Centres

Community Center Establishment

Reserved Site Demarcated



***Flexible Land Use and Public
Open Space Creation***

*Upgrading and Selective
Redevelopment*

Public Open Space Zoning



Recreation area at Yuhua Residential Estate. Photo courtesy of OnePeople.sg.

02

Embrace Diversity, Foster Inclusiveness

Singapore started out as an immigrant city and is now home to various ethnicities. These days, as Singapore fashions itself as a global city, even more people from around the world have come to work and live there. As the population grows, it also is becoming more diverse.

Diversity helps make the city an interesting place to live in, but with it comes a need to ensure that this diversity is not divisive, particularly in densely populated cities where people live close to one another. Density and diversity have generally worked in Singapore because there was always a concurrent focus on creating a sense of inclusiveness through encouraging greater interaction.



Streets in Little India all dressed up for "Deepavali" (Festival of Lights). Photo courtesy of Dr. Keith Stead.

Diversity in Culture Skills and Interests

Singapore's diverse population has created a rich multicultural environment that gives the city its character. Within the city are distinct ethnic districts such as Chinatown, Kampong Glam, and Little India, all of which keep alive the cultural heritage of Singapore's immigrant past.

Having a diverse population has also contributed to Singapore's economic competitiveness by throwing together people with varied skills, knowledge, and entrepreneurial abilities. The multilingual workforce helped Singapore gain wider access to global markets, creating new opportunities for the local economy. It has also been a plus point for international companies setting up regional offices in the city.

In a densely populated city with a diverse population, chances are good that one can find people with shared interests, making it easy to build informal interest-based communities. Proximity is an advantage in this pursuit. Community centres and clubs in the various residential estates also facilitate getting people from all walks

of life together to pursue common leisure interests or to learn new skills.

Inclusiveness and Interaction

Inclusiveness fosters trust, cohesion, and understanding among demographically diverse communities. Singapore's approach has been to increase the opportunities for contact and interaction between different groups. The design of Singapore's public housing is a case in point.

From the start, flats in public housing estates were allocated through a quota system which meant that people from different races and ethnicities had to live next to one other. Design features such as "void decks"—clear ground-floor spaces in each apartment block with no perimeter fencing—encouraged neighbours residing in these housing estates to interact. In addition, spaces in public housing estates have been created with "multiple thresholds": people can move from public spaces such as void decks to semipublic spaces such as corridors and then to the privacy of the home. These differentiations of public and private spaces were created, in place of boundaries and walls, to

enable a sense of community to exist alongside a sense of privacy.

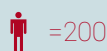
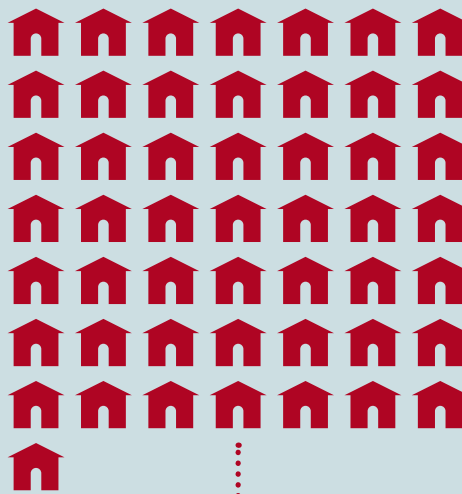
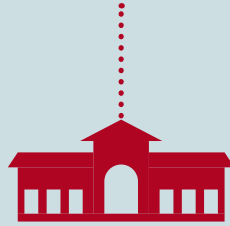
Policies and Programmes

Examples

- The Ethnic Integration Policy implemented by the Housing Development Board ensures a balanced ethnic mix in public housing estates, encouraging greater social integration.
- Conservation Plans of the Urban Redevelopment Authority have restored and preserved the built heritage of select city buildings and districts.
- Community centres at various convenient locations have created spaces for people to interact and engage in a range of activities.
- Community in Bloom and Community in Nature, led by NParks, are examples of community programmes that have helped create social networks among people with shared interests.

106

community clubs; each serves approx 15,000 households, or an average of 50,000 people¹



Strategy

- A city needs to recognise the different needs and cultural ethos of its diverse population base and create conditions for this cultural diversity to be a plus point. Use of public policy tools along with the smart design of the city's limited physical space can help make the best of the city's diversity and heritage, and encourage greater social interaction among its residents.

Actions

- Work with the various communities on programmes that embrace and celebrate the unique characteristics and diverse cultures of the city.
- Develop policies to intervene and create opportunities for diverse groups to live close to each other in the dense city environment.
- Introduce design elements and features which enable private and public spaces to blend seamlessly with each other, creating more venues for social interaction.
- Encourage events, programmes, and activities which bring together "strangers" with similar interests to create informal communities.

Outcomes

- A vibrant city life.
- Low intergroup, intercommunity friction.

Challenges

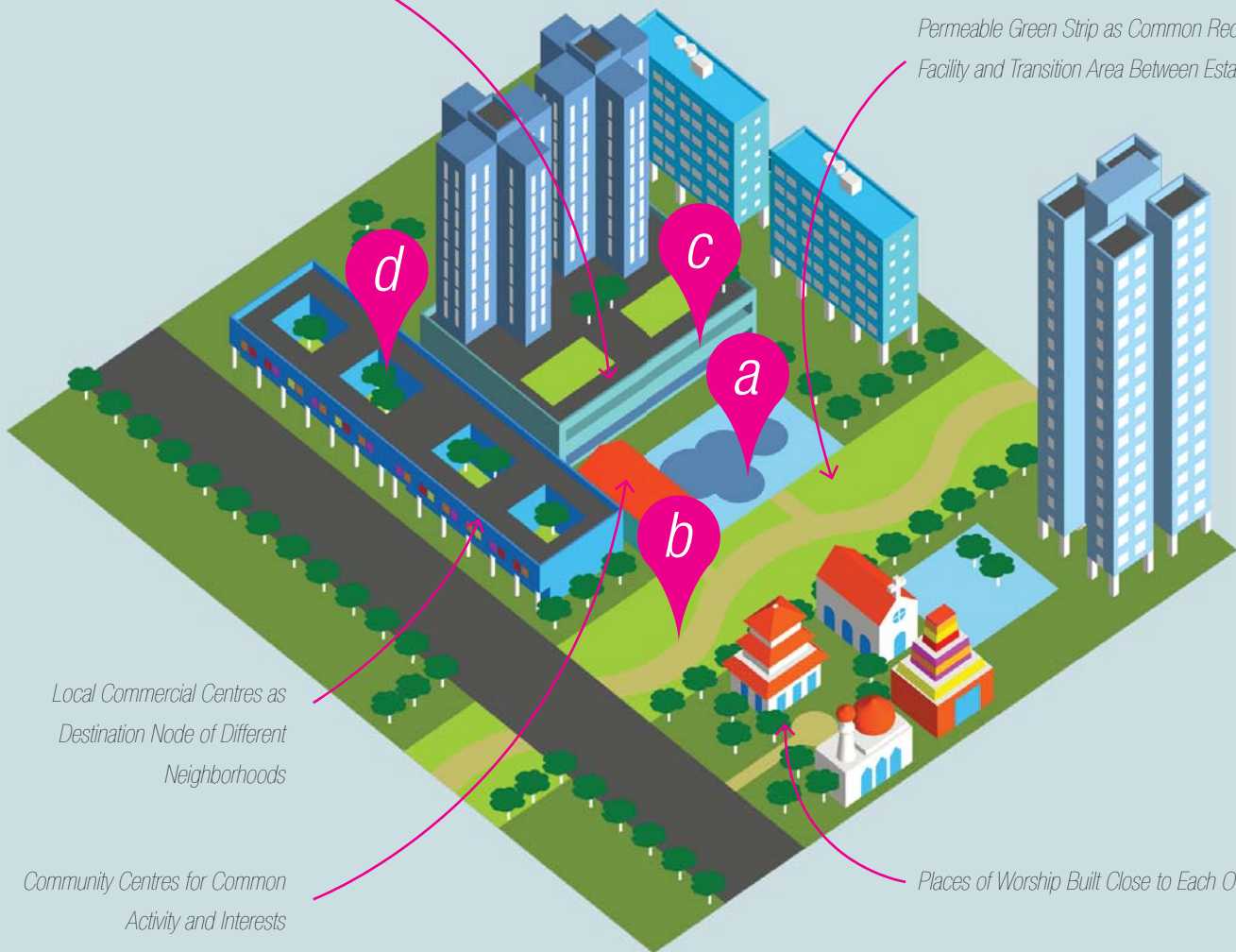
- Ensuring appropriate allocation of resources among varied socio-economic groups
- Managing the integration of diverse communities with distinct interests

Source:

1. People's Association.(2012).Community Club Management Committees, Singapore. Retrieved from <http://www.pa.gov.sg/>

Dedicated Gardens for Local Residents

Permeable Green Strip as Common Recreational Facility and Transition Area Between Estates



Local Commercial Centres as Destination Node of Different Neighborhoods

Community Centres for Common Activity and Interests

Places of Worship Built Close to Each Other

Inclusive Spaces

In high-density residential estates, many of the amenities are located and shared among different interest groups formed by the local residents. Urban and streetscape design help connect different activity areas to give a sense of community without compromising the individual privacy of local residents.

(A) A "Bird Singing Corner" in Tiong Bahru estate enables bird lovers to congregate and hold bird singing competitions. It was built near a "kopitiam" (local coffeshop) so that the spectators would have a place to sit and at the same time patronise the local businesses. *Photo courtesy of Gandara.*

(B) Canals and waterways demarcate estate boundaries and also serve as linear parks that connect different neighbourhoods as part of a network of recreation trails and activity nodes. The Bishan cycling trail is part of the park connector that passes through different residential estates, parks and neighbourhoods. *Photo courtesy of Diane Flaviano.*

(C) Dedicated open lots are used for community gardening. As part of the "Community in Bloom" national gardening movement, public and private estates are allowed to use common green spaces around the residential blocks and road verges for gardening, managed by local associations and committees. *Photo courtesy of Nparks.*

(D) Markets and retail centres are meeting points for the local residents. Geylang Serai is a market complex at the heart of the Geylang district. It is an important node for local commercial activities, and it also promotes Malay culture through its architecture and the social events around Hari Raya. *Photo courtesy of Rodeo Cruzado Cabillan.*





The vertical greenery and roof deck gardens of the Orchard Central shopping mall flourish in the busy commercial Orchard Road stretch. Photo courtesy of Rodeo Cruzado Cabillan.



03

Draw Nature Closer to People

Blending nature into the city helps soften the hard edges of a highly built-up cityscape and provides the residents with pockets of respite from the bustle of urban life.

What started as an aim to build Singapore into “a garden city” has now evolved into Singapore being “a city in a garden”. In addition to the many parks scattered across neighbourhoods, water bodies course through the city and form an important part of the landscape. Nearly half of Singapore is now under green cover, which is not only aesthetically pleasing, but also is good for the air quality and mitigates the harsh heat of the tropical sun.

Another aim of having Singapore residents experience nature as an integral part of their lives is to encourage them to value and, as a result, take better care of the environment and the city's limited natural resources.



The Southern Ridges is a ten kilometre trail composed of treetop walks, pedestrian bridges and town parks passing through the three residential areas of Alexandra, Henderson and Telok Blangah. Photo courtesy of Rodeo Cruzado Cabillan.

Pervasive Greenery

In creating "a city within a garden", Singapore, being highly dense and land scarce, faced a practical limit on how many parks it could have. Therefore, instead of only making horizontal spaces greener, Singapore adopted a strategy of "pervasive greenery", meaning the city inserted greenery wherever it could—be it on the pavement, a road divider, a building facade, or a rooftop. The idea was to cloak spaces with green wherever the eye could see.

Singapore has a Streetscape Greenery Master Plan. Tree-lined roads provide shade for motorists and pedestrians while overhead bridges and flyovers, including the area under the flyovers, are veiled with creepers and other plants to lend a softer feel to these concrete structures. The city has introduced various methods to bring greenery to buildings—for instance, green roofs, rooftop gardens, greening of vertical walls, and landscaped balconies. The National Parks Board has actively promoted vertical greening through incentive schemes and awards, and has even published extensive guides on "skyrise greenery". In short, Singapore has managed to create tiers of highly visible greenery

from ground level up to the building tops, seeing opportunity in the high-rise structures that form the cityscape as a means, rather than an impediment, to introduce more greenery.

Parks and Water Bodies

Singapore has transformed its parks and water bodies into lifestyle spaces for recreation and community activities, giving many leisure options to residents who seek a break from concrete and glass.

Parks in Singapore are fitted with features such as barbecue pits, food and beverage outlets, and campsites, and in one case, even a spa. The city has also used design and engineering to make its rare forested areas more accessible. For example, the Forest Walk and Canopy Walk bridges at the Southern Ridges wind through a secondary forest in Singapore, allowing city dwellers to enjoy the city's surprisingly rich biodiversity in a fairly untouched state.

Since the early 2000s, Singapore's water bodies have increasingly become part of the aesthetic and recreational landscape with the launch of the Active, Beautiful, Clean Waters (ABC Waters) Programme.

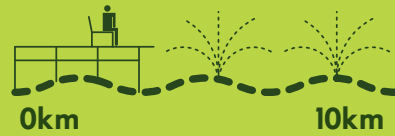
Everything from the city's drains to its canals and reservoirs was targeted for cleanup and transformed into clean and aesthetically pleasing lifestyle spaces. The surrounding physical landscape of the water bodies was designed to support activities such as jogging and cycling. Some of the water bodies were redeveloped beyond their functional use as water catchments, opening for water-based sporting activities. Because the maintenance of clean and functioning water catchments has been crucial for the city's sustainable water supply, one aim of the ABC Waters Programme has been to encourage city residents to value the water bodies so that they feel a vested interest in keeping them clean.

Policies and Programmes

Examples

- Various plans, such as NParks' Singapore Green Plan and Streetscape Greenery Master Plan and the water agency (PUB)'s Active, Beautiful, Clean Waters Master Plan, help guide nature development and integration projects.

- The Landscaping for Urban Spaces and High Rises (LUSH) programme introduced by the Urban Redevelopment Authority and NParks encourages the provision of greenery within developments and includes incentives related to gross floor area exemptions.



90km

total waterways length for recreational activities by 2020.

2/3

of land area used as water catchment, optimised at 90%.

46.5%

of green cover.

8,000sqm

of green park space per 1,000 persons.

Strategy

- Make nature part of everyday life through the introduction of "pervasive greenery", as well as the design of water bodies, development of better access to natural spots, and creation of spaces to allow residents to be near nature.

Actions

- Identify areas where introduction of vertical green space is feasible.
- Develop policies and incentive schemes for developers to encourage introduction of green space, both vertical and horizontal.
- Create recreational spaces for city dwellers in parks and along water bodies.
- Facilitate access to hard-to-reach nature spots through ecofriendly engineering and design.
- Integrate water into the urban environment.

Outcomes

- Biologically diverse spaces.
- Cooler surface temperatures and reduced heat-island effect.
- A high percentage of city dwellers engaged in recreational activities connected to nature.
- A visually appealing city.
- Increased biodiversity and ecological habitat.

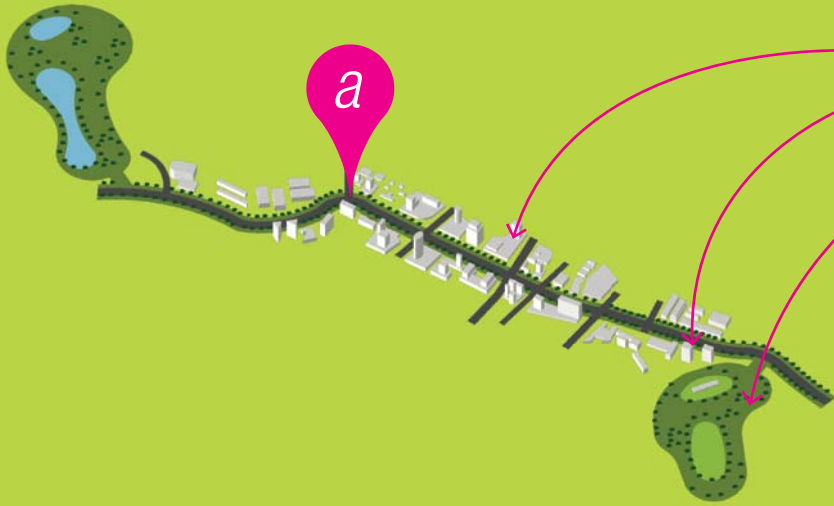
Challenges

- Complexity of coordinating inter-agency efforts.
- Difficulty in actively engaging the private sector.
- Upkeep and maintenance cost.

Source:

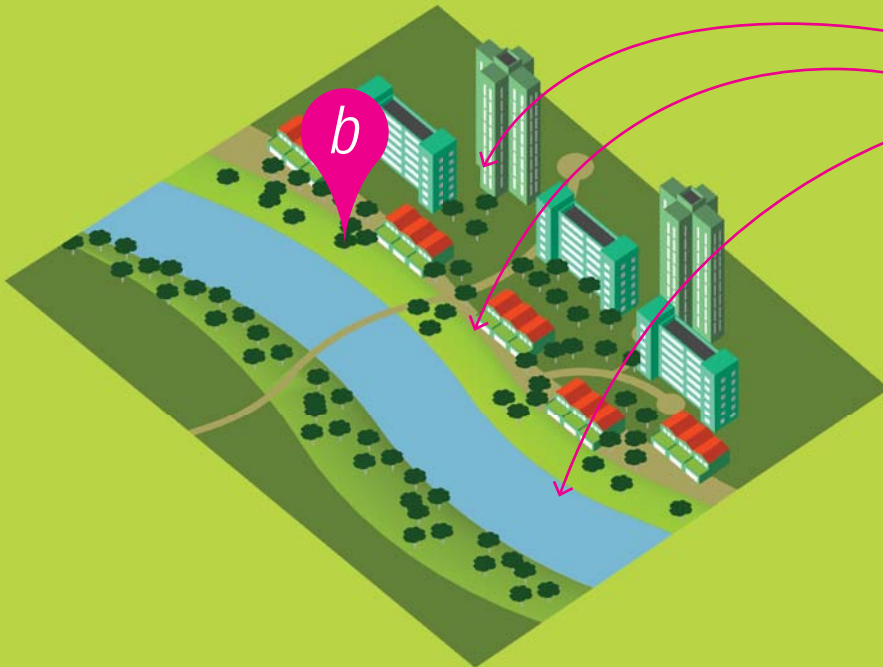
(All) Inter-Ministerial Committee on Sustainable Development. (2009). A lively and sustainable growth: Strategies for sustainable growth.

Singapore Botanic Garden, Orchard Road and Fort Canning Park



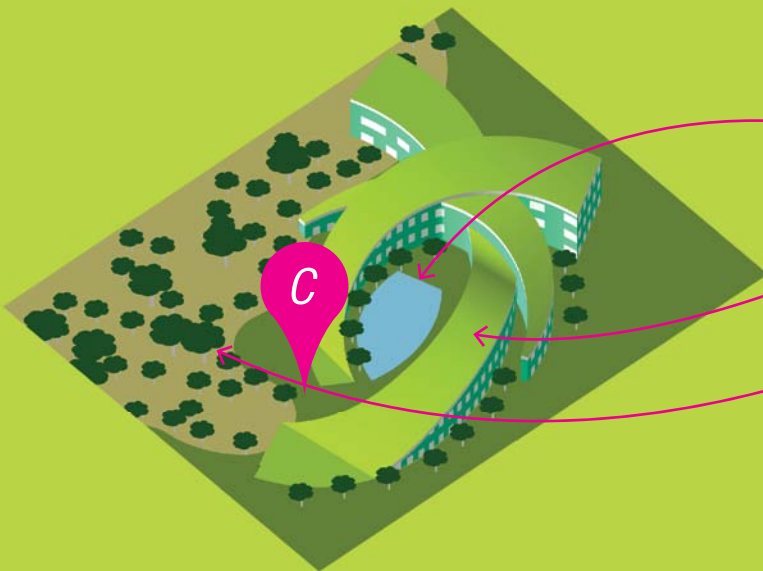
Commercial Districts connected to Town Parks through Green Boulevard

Alexandra Canal



Residential Estates Along Park Connectors and Canal Waterways

Nanyang Technological University's School of Art, Design and Media



Institution Complex with Green Roofs near Woods Reserves



"Shades" of Green

(A) Orchard Road, Singapore's main retail and entertainment street, is a 2.2 kilometre tree-lined boulevard with wide pedestrian walkways. The Botanic Gardens and Fort Canning Park flank the northwest and south-east ends of this commercial district. This abundance of greenery provides relief from the hustle and bustle of commercial activity and traffic. *Photo courtesy of Rodeo Cruzado Cabillan.*



(B) The Alexandra Canal runs through housing estates and park connectors, and is lined at various points with amenities like fitness equipment, mini skate stations, look out decks and community plazas, as well as a series of wetlands to treat the canal water. *Photo courtesy of AECOM.*

(C) The integration of natural scenery with modern architecture is apparent at the Nanyang Technological University's School of Art, Design and Media. The organic, vegetated form brings in nature and serves as an informal gathering space. It also insulates the building and harvests rainwater for landscaping irrigation. *Photo courtesy of AECOM.*





Clementi Mall is an example of a district node where a public mass transit station, bus interchange, retail outlets and a 40-storey public residential apartment are seamlessly integrated with one another. Photo courtesy of AECOM.

04

Develop Affordable Mixed-Use Neighbourhoods

The ease of living in a compact, populated neighbourhood that is relatively self-contained can add to the pleasure of city living. When basic goods and services, as well as schools and recreation areas, are put within reach, there is less need to commute to the city centre. Density also works well for city governments and local businesses. Once there is a critical mass, it becomes more cost-effective to provide common amenities to the neighbourhood. Businesses also have enough patrons.

Neighbourhoods in Singapore's new towns are served with a full range of amenities that are easy to access and generally affordable. They are also developed taking into account the hierarchical distribution of the population, land uses, open spaces, and infrastructure. They provide a unique, high-density, high-liveability experience.





Buyers look at new flats in a public housing gallery. The government ensures public housing affordability by giving priority to first-time buyers as well as subsidies according to their income. Photo courtesy of Rodeo Cruzado Cabillan.

Mixed-Use Neighbourhoods with Affordable Homes

Singapore's towns have a mix of public and private developments. Public housing buildings in Singapore's neighbourhoods are usually a mix of nine- to 13-storey slab blocks and 20- to 25-storey point blocks. Co-located with them are various types of private residential developments which include landed properties and high-rise condominiums. The size and amenities of each apartment are

designed to meet different affordability levels and lifestyle choices. Common amenities, such as shops, clinics, eating establishments, and markets, are located within a 400-metre radius of the neighbourhood centre and can be easily reached on foot or by public transport. The quality of these amenities is regularly updated with changing times and needs. Today residents can shop at air-conditioned suburban malls, which have shops, supermarkets, and cineplexes. Besides land for residential purposes, each town has space allocated for commercial, industrial, and open space, and other uses.

The planning guidelines for these towns also take into account the ease with which residents can access the larger transport network. Major and minor roads, shaded pedestrian walkways, bus stops, and underground stations are well integrated into the town plan.

Policies and Programmes

Examples

- The Housing Development Board's guidelines and planning standards ensure equitable and adequate distribution of amenities at the town, neighbourhood, and precinct levels.
- The Central Provident Fund's Public Housing Scheme helps make homeownership more affordable and accessible.

81.6%

Singapore residents living in HDB flats (2012)¹



Source:

1. <http://www.singstat.gov.sg/stats>.

Strategy

- Take advantage of the fact that dense cities and compact neighbourhoods can make it cost-effective for city governments to provide shared amenities and efficient transport linkages that can add to the convenience of city living.

Actions

- Develop compact, affordable, and self-sufficient districts/new towns with good amenities and public transport options.
- Introduce elements of mixed-use living in existing neighbourhoods and supplement them with common amenities.
- Connect neighbourhoods and amenities with pedestrian walkways and nearby public transport nodes.

Outcomes

- Amenities within walking distance.
- Integrated-income homes.
- Good accessibility and affordable housing/districts with high-quality environments.
- Reduction of traffic stress in the central areas of the city.

Challenges

- Balancing the demand and supply of quality built housing estates.
- Creating a quality built environment while keeping costs low.



Kayaking in the Punggol Waterway, a revitalized waterway connecting two main reservoirs in Singapore. Photo courtesy of HDB.



05

Make **Public Spaces** Work Harder

Strolling through Singapore, one would find unusual public areas being put to use—spaces under railway lines, next to canals, on top of buildings, and near underground railway stations. Often in other cities, parcels of land adjoining, in between, or surrounding the infrastructure are dead spaces. These dormant spaces are a luxury most cities cannot afford to waste. By unlocking these otherwise “unused” spaces for commercial and leisure activities, Singapore has redefined the concept of what is usable space. The idea is to make all space, including infrastructure spaces, serve multiple uses and users. In this way, Singapore has increased the land available to meet the lifestyle needs of its residents.



The Marina Barrage's rooftop was designed as a green deck, creating a new public park. It is now a popular spot for kite-flying, picnics and social events. Photo courtesy of PUB, Singapore's national water agency (Insert) and Nina Cecilia Ballesteros (Background).

Creative Use of Space

In Singapore, the land alongside canals and drains is fitted with walking and cycling tracks, as well as exercise equipment. Almost instantly people get drawn to use these recreational facilities. Spaces under flyovers have been used for futsal, while large public car parks have been the venue for go-karting events. Parks which are generally dormant places at night have also been used as venues for large-scale concerts.

Because Singapore is a fairly built-up city, it has also looked to open up

space underground, an effort centring on the city's subway transport nodes. Underground walkways connecting the train stations and buildings are populated by lifestyle and leisure outlets. In one key transport node, the subterranean walkways cover more than 60,000 square feet and host more than 50 retail outlets.

The city has also made rooftops double as public spaces. Several recently built high-rise buildings in Singapore have created rooftop gardens, and some commercial complexes have also included swimming pools, food and beverage outlets, and viewing decks atop the

buildings. Rooftop spaces that offer breathtaking views of the city have become popular tourist attractions.

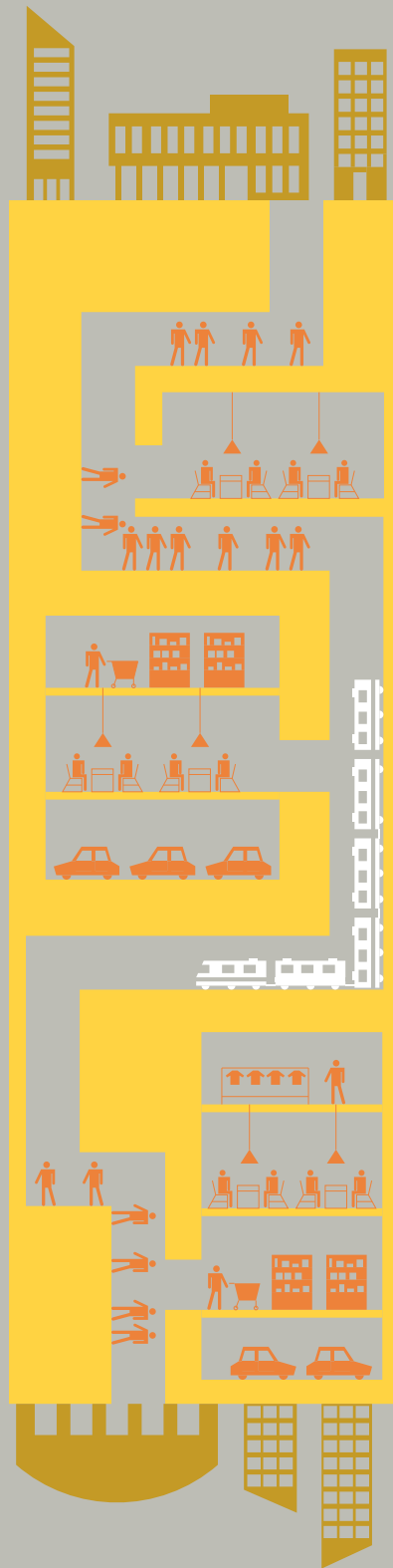
Policies and Programmes

Examples

- Incentives and schemes, such as the Skyrise Greenery Incentive Scheme, bonus gross floor area incentives, and Temporary Occupation Licenses for interim use of land, facilitate the multiple use of spaces.
- PUB's Active, Beautiful, Clean Waters and NParks' Park Network Connector programmes have activated underused land parcels and infrastructure facilities.
- The Urban Redevelopment Authority's Landscape Replacement Policy for Strategic Areas ensures that greenery and landscape areas equivalent to the area of the development site will be replaced either at the ground level or vertically.

60,000sqft

of subterranean walkway in City-Link Mall connecting over 50 retail shops¹



Source:

1. City Link Mall. (n.d). Retrieved from <http://www.citylinkmall.com/about>

Strategy

- Either through development or programming, reinvent unused or dormant spaces to serve additional functions that add to the life of the city

Actions

- Encourage multiple uses of land by equipping parcels with features which allow land to be used in different ways.
- Get addition and alteration (A&A) approvals for buildings so they open up to/connect underground.
- Introduce flexible spaces in the city for people to host and enjoy different small- and large-scale events.

Outcomes

- Creation of more spaces for leisure and commercial activities without the need to build new structures that add to the bulk of the city.

Challenges

- Existing zoning and building by-laws may restrict overlapping land uses.
- Coordinating land uses and developments in a way that is not mutually conflicting can be challenging.

Multi-Tasking Spaces

Ordinary public infrastructure like canals, elevated rail lines and rooftops double up as usable public spaces for leisure and recreation.

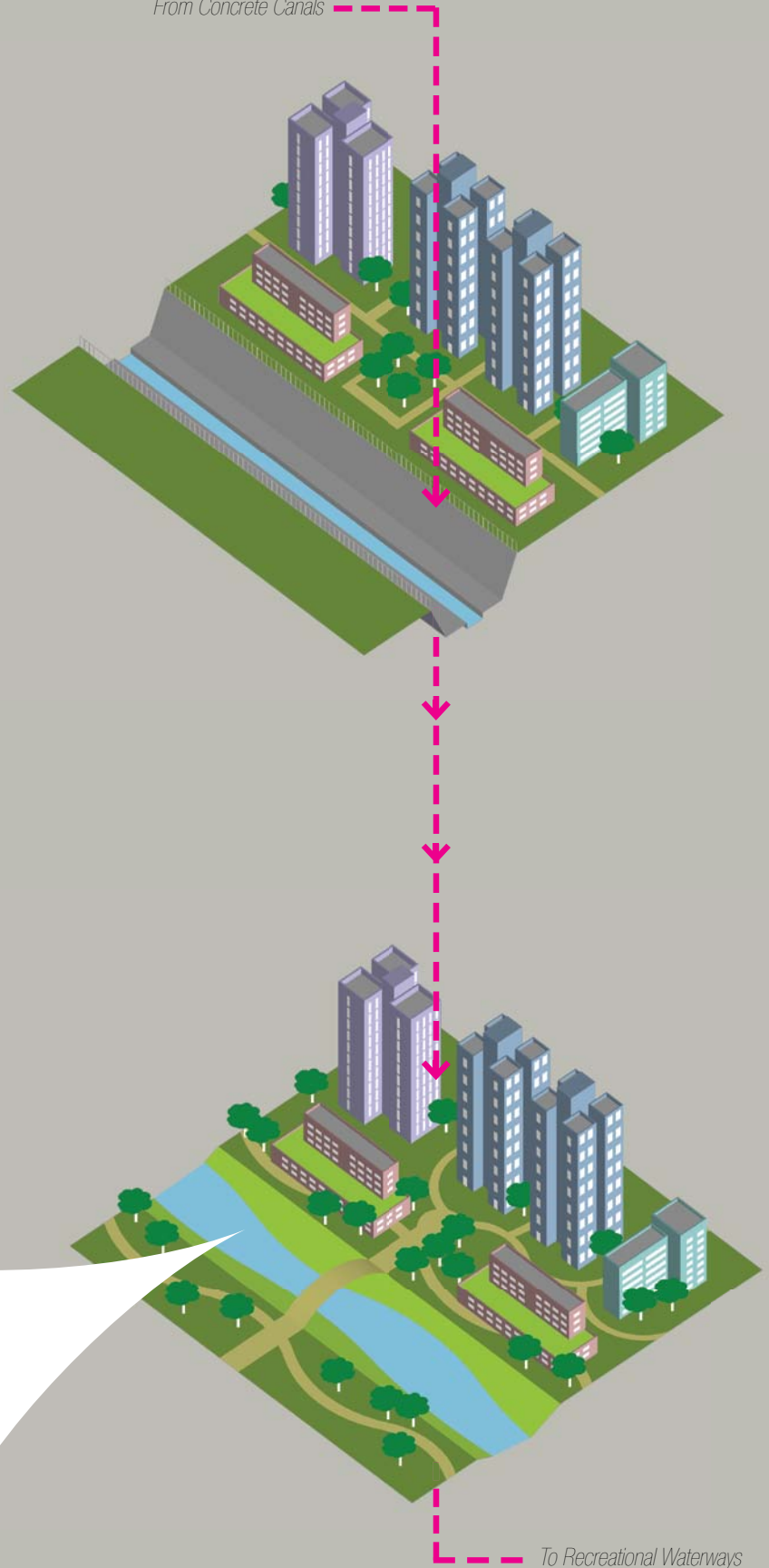
(A) The Bishan - Ang Mo Kio Park is a concrete canal that was converted into a naturalized river with bioengineered riverbeds. *Photo courtesy of CH2M HILL.*

(B) Spaces under the elevated rail lines are developed with paved walkways and landscaped corridors to become jogging tracks, cycling lanes and park connectors. *Photo courtesy of avocadolite.com.*

(C) Pinnacle @ Duxton Plains, a residential development, has roof decks with play areas and viewing decks. The utility facilities are concealed. Sky bridges connects the rooftops of all seven towers creating a contiguous public space 50 storeys above ground, accessible to both residents and non-residents. *Photo courtesy of AECOM.*

Waterways Revitalization

From Concrete Canals

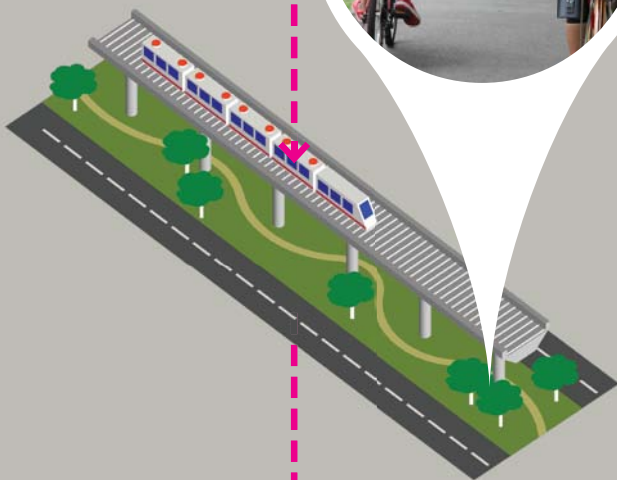
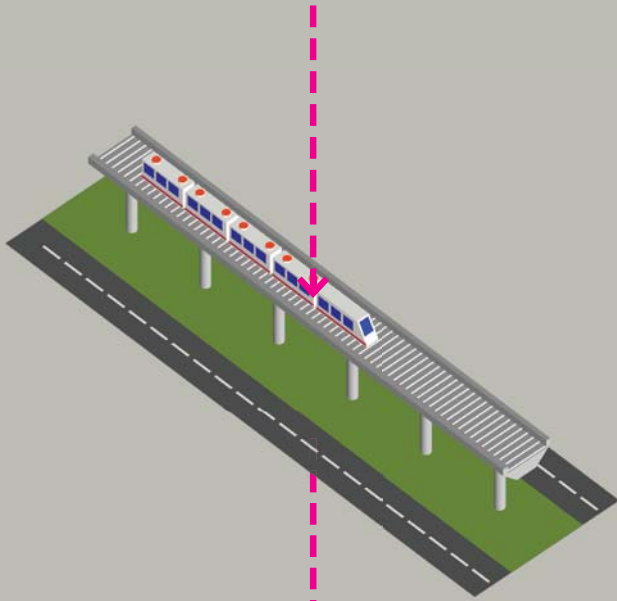


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Interstitial Space Utilisation

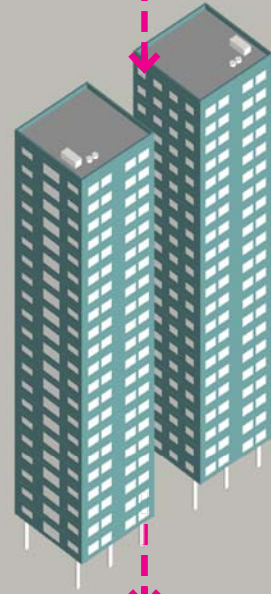
From Empty Lots Under Mass Transit Lines



To Cycling Paths

Multi-purpose Spaces

From Utilitarian High Rise Roof Decks



To Sky Gardens



Integrated transportation system at Sengkang MRT-LRT Station. Photo courtesy of Rodeo Cruzado Cabillan.

06

Prioritise Green Transport and Building Options

A switch to greener transport and buildings systems that use resources more efficiently increases the liveability of highly dense cities in several ways. Greener transport in terms of an energy-efficient public transport system and environmentally friendly cars helps reduce the pollution and congestion that make city living unpleasant and unhealthy. Energy-efficient buildings help mitigate the effect of urban heat sinks. Cities like Singapore—through its individuals, buildings, transport, and industry—are large consumers of energy. An overall reduction in energy consumption and dependence across the board adds to the sustainability of the city.

From the start, Singapore adopted a resource-conscious growth strategy that relied on planning, design, and choice of low-energy environmental systems for its buildings. Singapore continues to encourage use of resource-efficient green technologies in its buildings and industries through incentive schemes and certification programmes. It has also sought to develop an efficient public transport system and well-connected walkways (above ground and underground) in order to give city dwellers practical alternatives to using their private cars.



The solar park in Marina Bay is the largest field of solar panels in Singapore, generating 50 per cent of the daytime electricity needs of the Marina Barrage facility. Photo courtesy of PUB, Singapore's national water agency.

Moving People Away from Car Use

Singapore has sought to encourage more of its residents to use public transport rather than cars. To this end, it has developed an extensive, integrated, and affordable public transport network composed of buses, light rail, and mass rapid-transit systems to offer seamless connectivity. At the same time, it has also discouraged the use and ownership of cars through policy tools such as the electronic road pricing system, congestion pricing, the mandatory certificate of entitlement for vehicle ownership, and fuel pricing. Currently, the morning peak-period public transport ridership in the city accounts for 59 per cent of commuters, and the city aims to increase this to 70 per cent by 2020.

The city has also encouraged cleaner forms of commuting such as cycling by putting in place park connectors; it also plans to develop cycling networks, as well as bike parking facilities at transit stations. The availability of shaded pedestrian walkways encourages people to undertake short trips on foot. In this, the city's compact nature is an advantage.

Green Buildings

The city has made pointed efforts to reduce the amount of energy consumed by its buildings, with a view to mitigate the urban heat-island effect and reduce the city's carbon footprint. Singapore has encouraged the development of "green" buildings through its Green Mark Incentive Scheme. All new buildings in the city have to meet the Green Mark Certified rating, and existing buildings are encouraged to retrofit their cooling, lighting, and water reticulation systems.

The long-term benefits of investing in green technology can outweigh the high initial costs, which deter many cities from looking at greener options. Indeed, embracing green technology upfront reduces the costs associated with maintenance and retrofitting of existing buildings. Currently, the Housing Development Board of Singapore is looking to embark on an islandwide test-bed for solar technology within 30 public housing precincts.

Green Districts

Singapore has also looked at district-level measures such as shared infrastructure for cooling, heating, and waste management, which become cost-effective at high densities. Marina Bay was developed to be a

sustainable high-density district. All new developments there are required to meet a higher Green Mark rating and also provide for sky-rise greenery and communal landscaped areas. A district cooling system was put in place to take advantage of the economies of scale. A new waterfront promenade around Marina Bay has design features to cool the ambient air temperature, energy-efficient LED lighting, and solar-powered outdoor fans.

Policies and Programmes

Examples

- The Land Transport Master Plan, developed by the Land Transport Authority, provides strategies to encourage the use of public transport and green transport.
- Cycling is encouraged by NParks with a 150-kilometre Round-Island-Route and by the presence of cycling paths and support infrastructure being developed by the Land Transport Authority.
- The Land Transport Authority deploys tools such as the Electronic Road Pricing system, the Certificate of Entitlement bidding system for car ownership, the Off-Peak Car scheme, and the Park and Ride scheme to reduce overall car use.
- Energy efficiency of buildings is promoted through schemes such as the Building and Construction Authority's Green Mark Incentive Scheme, which includes cash incentives to retrofit and to conduct energy audits of existing buildings.



60min

overall time that 66% of public transport commuters take to complete their journey during morning¹ peak hours.

59%

public transport mode share¹

110

Private Cars per 1,000 Population²

1,600

Bicycle parking racks (as of Sept' 12) and proposed to be increased by 900 at 10 MRT stations and bus interchanges³

1,000

13% of Singapore's buildings—which is approximately 29 million sq.m. GFA—have achieved BCA Green Mark standard.⁴

80%

Green Mark Buildings in Singapore (by 2030)⁵

Strategy

- Take advantage of the city's compact layout and density to reduce energy consumption in transportation and reap economies of scale through shared infrastructure. Set performance standards for the industry to construct energy-efficient buildings.

Actions

- Improve the connectivity of the public transport systems, looking at needs of both commuters and pedestrians.
- Create energy-performance standards and incentive schemes to encourage development of green buildings.
- Identify green districts for development.

Outcomes

- An increase in public transport ridership.
- A reduction of pollution, congestion, and urban heat.
- A reduction in overall energy consumption.

Challenges

- High upfront cost of installing green technology deters widespread adoption.
- Retrofitting existing building stock is not easy and can be very expensive to undertake.

Sources:

1. Land Transport Authority. (2008). Land Transport Master Plan 2008.
2. Statistics Singapore. (2011). Singstat Key Annual Indicators. Retrieved from <http://www.singstat.gov.sg>
3. Land Transport Authority. (n.d). Adding Bicycle Racks At MRT Stations. Retrieved from <http://www.lta.gov.sg>
4. Building Construction Authority. (2012). Singapore Celebrates 1,000th BCA Green Mark Building Project . Retrieved from <http://www.bca.gov.sg/>
5. Inter-Ministerial Committee on Sustainable Development.(2009). A lively and sustainable growth: Strategies for sustainable growth.

Energy Squeeze

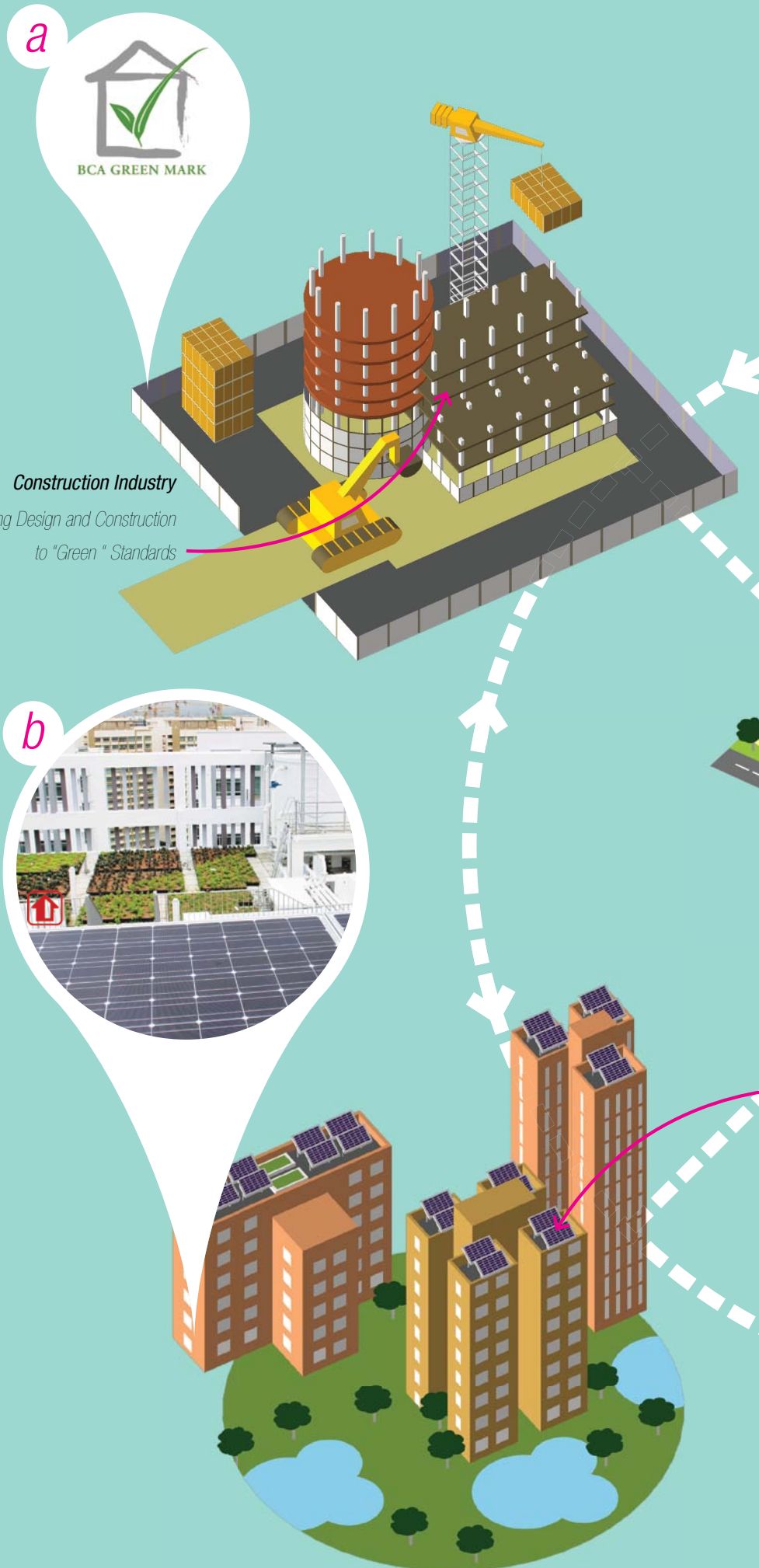
Energy and natural resources conservation starts from good residential, commercial, industrial and construction practices. It is further supported by the use of clean and efficient transportation.

(A) The BCA Green Mark is an initiative by Singapore's construction industry to benchmark building projects against the world's best practices in environmental design and performance. Having the mark in new or existing buildings adds to the market value of the estate and buildings. *Image courtesy of Building and Construction Authority of Singapore.*

(B) Treelodge @Punggol is Singapore's first Green Mark Platinum Award public housing project. The residential development incorporates a range of green technologies for effective energy, water and waste management. These include solar panels to generate lighting for common areas, centralised recyclable refuse chutes, a rainwater collection system, vertical greening and green rooftops. *Photo courtesy of HDB.*

(C) The city is providing its cyclists with better bicycle parking facilities near the mass transit stations to encourage the use of public transport. *Photo courtesy of ChuWa (Bike), Rodeo Cruzado Cabillan (Bus and MRT).*

(D) The Keppel Merlimau Co-generation Plant, using natural gas resources, is able to generate electricity, and provide steam and demineralised water to the petrochemicals plants located on Jurong Island. *Photo courtesy of Keppel.*



Construction Industry

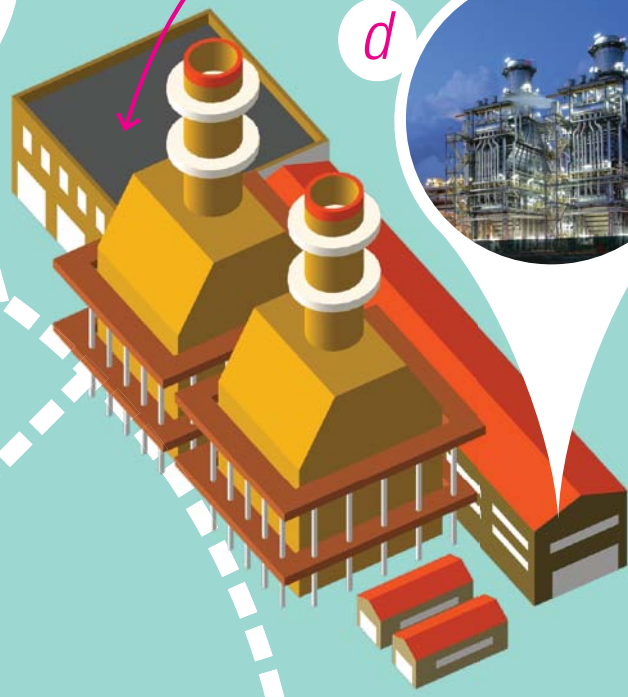
Building Design and Construction to "Green" Standards

b

Industrial Sector

Co-Generation and Tri-Generation of Power in Industrial Facilities

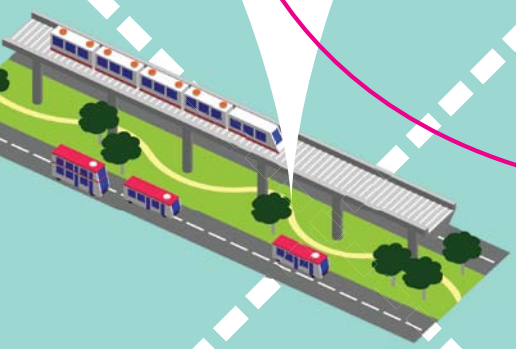
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Transportation Sector

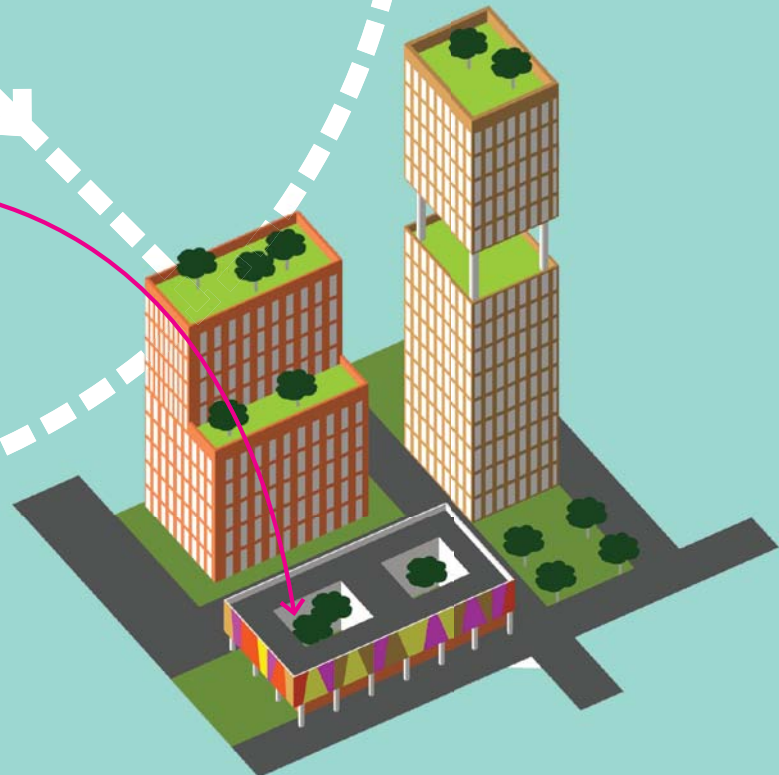
Integrated Public Mass Transit Stations and Cycling Network

c



Residential and Commercial Buildings

Renewable Energy Resources, Active and Passive Climate Responsive Designs at Public Housing Estates and Commercial Centres.





Raffles Institution students bringing students through the ABC Waters Learning Trail experience at Kallang River @ Bishan-Ang Mo Kio Park. Photo courtesy of PUB, Singapore's national water agency.



07

Relieve Density with **Variety** and Add Green Boundaries

A high-density city need not be, and should not be, all about closely packed high-rise buildings. Interspersing high-rise and low-rise buildings creates a skyline with more character and reduces the sense of being in a crowded space. Putting green boundaries around neighbourhoods not only gives residents relief from the concrete structures, but also helps create distinct precincts and communities of a friendlier size. Physically, the city also appears less overwhelming.

Singapore relied on “checkerboard planning” in which high-rise developments were separated by lower-rise developments to provide a more spacious feel. The new towns—which tend to be densely populated—are set apart by large swathes of green or open spaces.



Before and after photos of canal restoration in Bishan- Ang Mo Kio Park as part of PUB's Active, Beautiful and Clean (ABC) Waters Project. The Kallang River serves as a green lung in between the Bishan residential estates. Town parks and facilities are located at the riverbanks for residents to enjoy being by the water. Photo courtesy of PUB, Graphic Work courtesy of Atelier Dreiseitl.

Spaces of Relief

Through Singapore's checkerboard planning, low-rise blocks and spaces (e.g., schools, community centres, sports fields, and parks) are juxtaposed with high-rise residential blocks in a checkerboard pattern to give the illusion of space and make the high-rise environment less harsh. It reduces the sense of crowdedness that can make living uncomfortable. Another feature used by Singapore's planners is the insertion of spaces of relief such as parks in between the high-rise developments. Residents get not only a recreational space close to their homes, but also a respite from the high-rise environment. An example

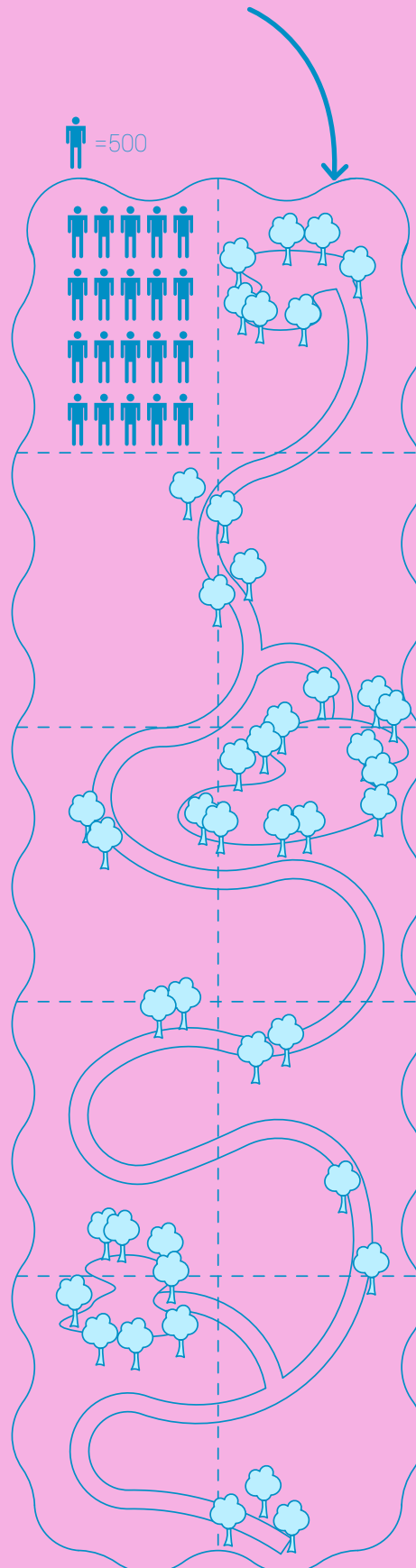
of this is the Bishan-Ang Mo Kio Park that sits between the new towns of Bishan and Ang Mo Kio. This park space, which was also redeveloped as part of the ABC Waters Programme, serves another purpose: it prevents towns near each other from melding into an indistinct neighbourhood. As such, each town retains its unique identity.

Policies and Programmes

Examples

- The Urban Redevelopment Authority's Development Guide Plans and the Housing Development Board's guidelines for New Town/Estate Structural Model guide the layout and pattern of development.
- The Urban Redevelopment Authority's Green and Blue Plan guides the development of green spaces and water bodies so they are seamlessly integrated with all other urban developments in the city.

109ha



Total outdoor recreational spaces per 100,000 persons.¹

Source:

1.NParks.(2010).

Strategy

- Use height gradation and density differentials to space out density and also create visual relief for the physical spaces.

Actions

- Use height variation in the planning of highly dense cities.
- Create pockets of low density to space out high-density developments.
- Introduce features which lend specific identity and character to individual neighbourhoods and estates.
- Develop and position relief spaces amidst high density built environments to create places of relaxation and recreational use for people.

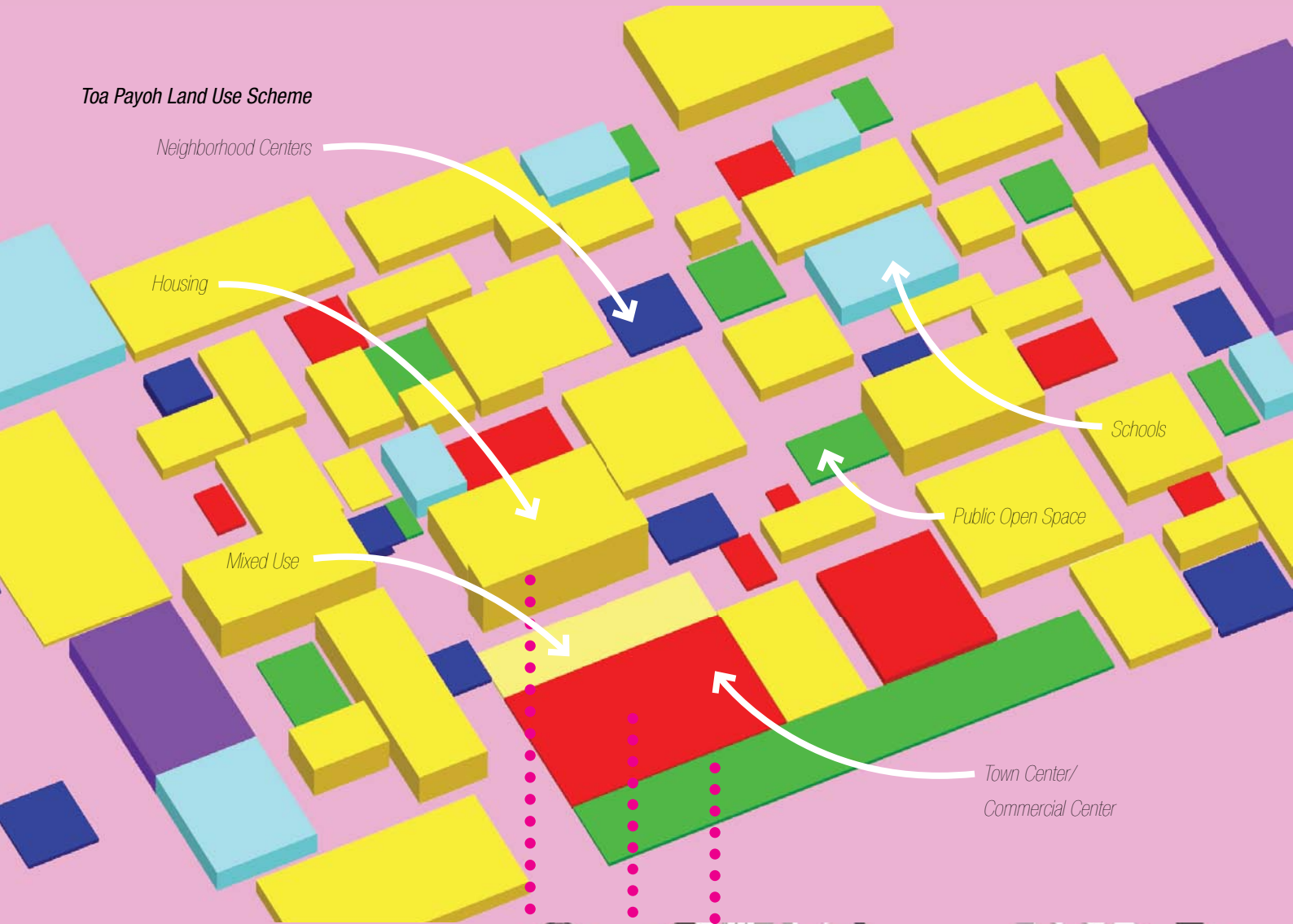
Outcomes

- Well-spaced-out neighbourhood centres within the confines of limited land.
- A good variety in the built environment and a skyline.
- Reduction of repetitive urban form and the feeling of being crowded.

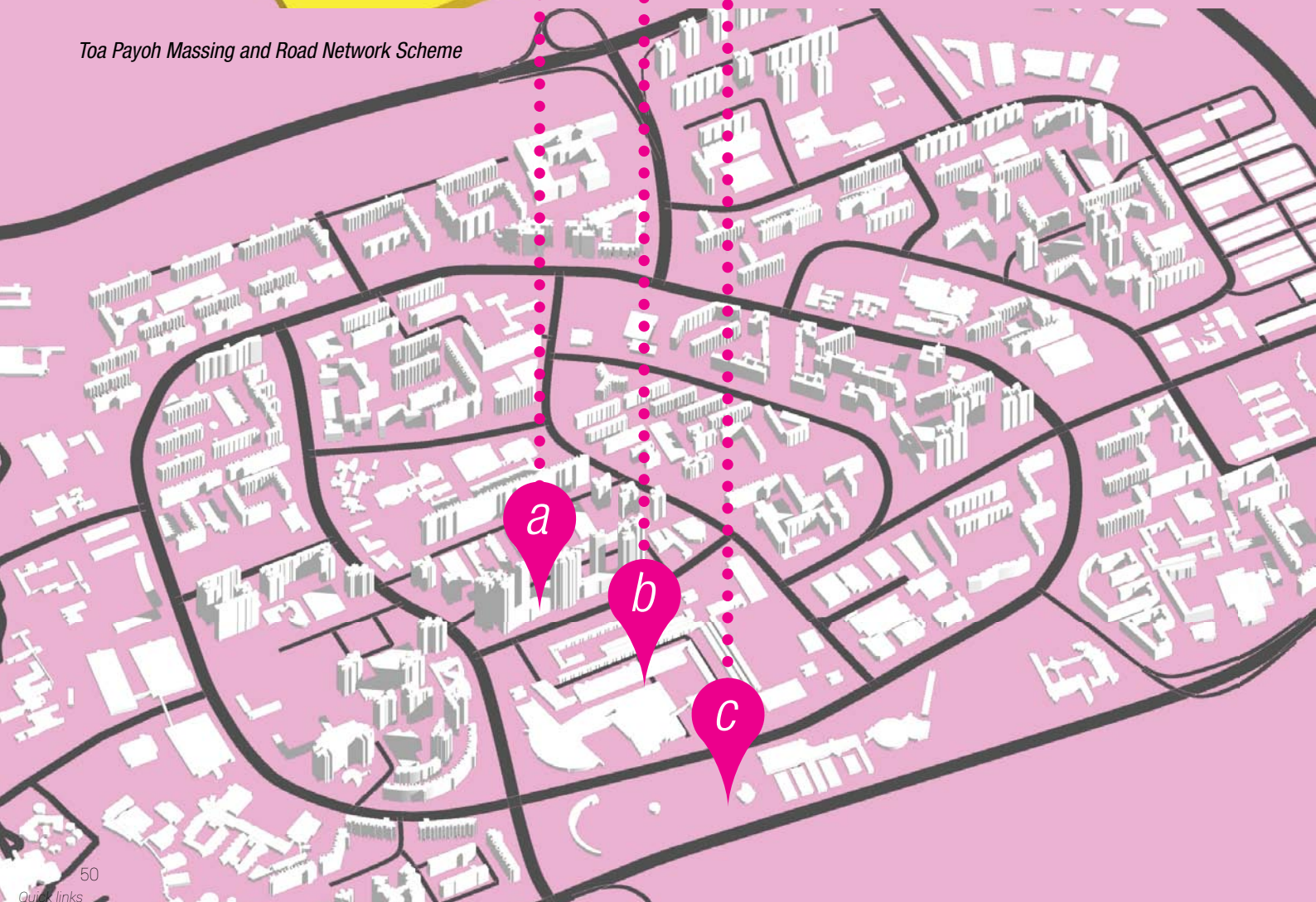
Challenges

- Competing demand for land for infrastructure development edges out greenery.
- Existing land use zoning with large land parcels provides fewer opportunities for insertion of green spaces accessible on foot.

Toa Payoh Land Use Scheme



Toa Payoh Massing and Road Network Scheme



Pieces of the Checkerboard

Toa Payoh town's urban form follows a "checkerboard plan" in locating the different residential areas such as educational facilities, public spaces, civic centres, commercial areas and transportation hubs. This variety in building mass, height, typologies and open space distribution breaks the monotonous and dense urban form.

(A) Central Horizon is a 40-storey residential apartment at the heart of Toa Payoh that gives it a unique identity. Its high-rise towers enable density while keeping to the original plot size. *Photo courtesy of AECOM.*



(B) The HBD Hub which houses the community center, retail shops, bus interchange and mass transit station is situated near Central Horizon. *Photo courtesy of AECOM.*



(C) The Toa Payoh Town Park is at the south end of the town, providing a central green public open space alongside the commercial hub and residential estates. *Photo courtesy of AECOM.*





Residents gather at a common area shared by different apartment blocks to watch a Chinese New Year Festival programme. Photo courtesy of Relan Masato.



08

Activate Spaces for Greater Safety

Having a sense of safety and security where one lives is an important factor in enjoying a high quality of life. Densely populated and highly built-up cities tend to be portrayed, sometimes unfairly, as unsafe places.

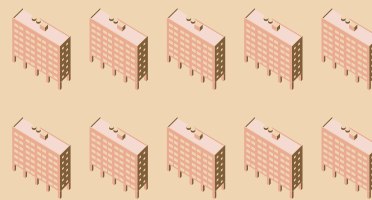
Singapore has worked to give its residents a stronger sense of personal security through a mix of well-thought-out urban design and government intervention.

The idea of designing and activating safe spaces comes from an urban design and space management perspective. As Singapore's new towns became denser, "visual access" to spaces are preserved so that the community can collectively be the "eyes on the street" and involved in keeping the neighbourhood safe.



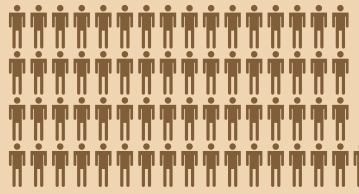
10 blocks

per precinct (average) which are collectively grouped into up to nine neighbourhoods!



2,600

neighbourhood watch groups²



1 icon = 40

Each neighbourhood comprises small precincts of approximately 400 – 800 dwelling units, allowing for a better sense of identity with place and neighbours in order to foster sense of ownership and pride.



Residential Estate Planned with Good Sight-Lines of Adjacent Spaces



Well Lit Public Spaces



Unhindered Sight Lines

Defensible Spaces

Carefully thought out design of space can help people living in high-density communities be less vulnerable to crime. Apartment blocks surrounding the playgrounds, events area and sports courts enable residents to see what is going on from their apartments. Ground areas are dedicated for specific uses such as playgrounds or sports facilities, creating a zone of influence and ownership. This is a principle of "defensible space" in that a specific group who uses a facility often would feel that it "owns" the place and would thus protect it indirectly through surveillance and regular occupation. Connecting residential common areas with the street and other busy places (i.e., local shops, police stations, community centres, etc.) makes surveillance of the area more effective. *Photo courtesy of STB.*



Adjacent Activity Areas and Pedestrian Networks

Greater Visual Access

Singapore new towns have activity spaces that are co-located and few "hidden corners". Spaces are designed in a system of channels and nodes so that thoroughfares are punctuated by active areas at the nodes. Playgrounds, public squares, intersections, and shops are co-located and organised in way that attracts foot traffic around the clock, creating a continuous buzz that adds to safety.

Similarly, the layout of high-rise public housing is such that the residents have clear views of their precincts, car parks, children's play areas, and pathways from their flats. The void-decks at the ground level of public housing blocks are visually barrier free. All in all, the design of the typical public housing estate enables residents to watch out for unusual activity in their neighbourhood that might threaten their safety. Most residential estates also tend have a community-friendly police presence in the form of neighbourhood police posts.

Singapore also encourages mixed-use developments—a departure from old-school planning which looked to strict zoning of business districts and residential areas, often resulting in dead spaces at night and on the weekend. The central business district (CBD) of Singapore initially was designed in the old-school way. However, it has been revamped to accommodate more restaurants (including waterside dining), hotels, and housing units so that the CBD remains fairly active in the evenings and over the weekends. It also means the city is making better use of its limited land in a prime area.

Policies and Programmes

Examples

- Use of the "precinct" as a basic unit of town planning has helped introduce communal activities at a local scale, which encourages better community ownership of such spaces.
- Design features and guidelines given in the Public Spaces and Urban Waterfront Master Plan ensure the safety in use of these spaces.
- Community-level interventions such as the Neighbourhood Police Posts and Neighbourhood Watch Schemes help increase the safety of residential spaces.

Strategy

- Increase the visual access to spaces through design to increase the community's ability to look out for threats to safety. Integrate activity spaces with other land uses to encourage a continuous stream of people and activities during the day, the night, and also on weekends.

Actions

- Develop design guidelines to improve visual access in developments, estates, and precincts.
- Identify spaces that become "dead" during the weekends or at day or night and redesign and redevelop them to accommodate multiple uses.

Outcomes

- Less crime in public spaces and streets.
- City residents with a stronger sense of personal safety.

Challenges

- Gated communities exclude outsiders and reduce interactions with the surrounding streets and spaces, reducing the scope for social bonds with the larger community that serves as deterrents to crime and other antisocial behavior.
- Existing urban design may not focus adequately on the safety of streets and public spaces.

Sources:

1. Seik, T.F (2001). Planning and design of Tampines, an award-winning high-rise, high-density township in Singapore. *Cities*, 18(1). doi: 10.1016/S0264-2751(00)00052-4.
2. Ministry of Home Affairs. (2012). Ministry of Home Affairs Committee of Supply Debate. Retrieved from <http://www.mha.gov.sg/>



Biopolis is part of the R&D facilities in the one-north business park which was formed with a "live/work/play" environment. Photo courtesy of Rodeo Cruzado Cabillan.

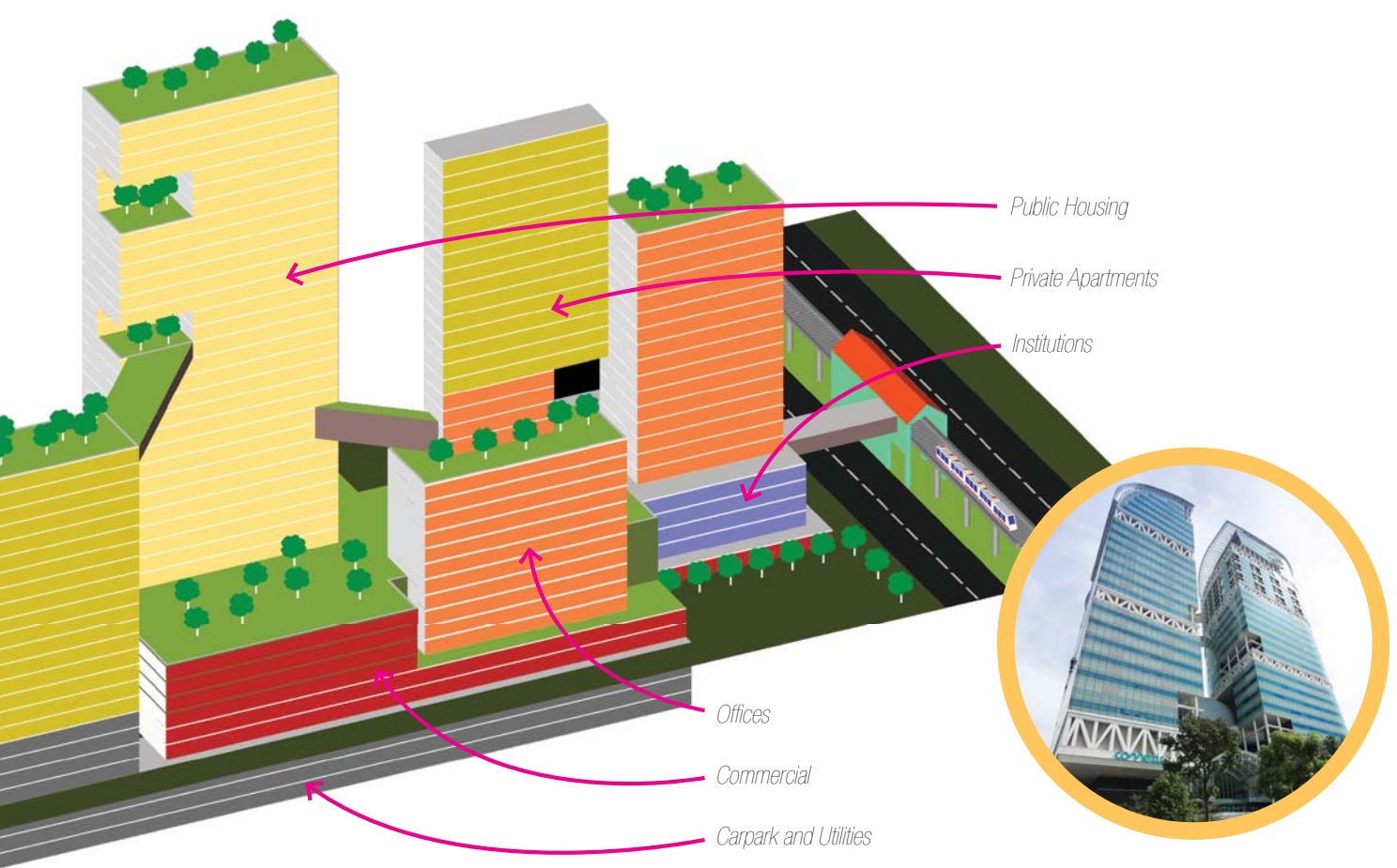


09

Promote **Innovative** and Nonconventional Solutions

As a city gets more and more populated and built up, it starts facing constraints, particularly on land and resources. Often the city has to look at non-traditional solutions and rely on innovative approaches or technology to get around the constraints.

Over the years, Singapore has relied on innovative ideas to mitigate its resource constraints. A strong impetus to innovate existed because the more conventional solutions simply would not work in Singapore's context. In the process, Singapore has also emerged as a leader in innovative urban solutions and in some ways become a living laboratory for testing resource-efficient technologies. An additional economic benefit has been the growth of an urban solutions industry in Singapore.



Vertical zoning is scheme used in developing and integrating different facilities in one-north business park in Singapore. In "Fusionopolis" (insert), residential floors are located at topmost level while offices, research facilities, institutional, utilities and commercial are arranged in a layered manner below. Photo courtesy of Rodeo Cruzado Cabillan.

Innovative Urban Solutions

For decades, ensuring sufficient water for residents as well as industrial needs had been a huge challenge for Singapore. Building more reservoirs to serve as catchments for rainwater or requiring individual developments to retain water was simply not an option; Singapore needed to implement a few innovative ideas. First, it started to develop the drains and canals to be part of the water catchment system and set a target of having 90 per cent of the land area serve as water catchments. Second, it took a leap of faith and developed reclaimed water—under the brand name NEWater—to drinking and industrial standards (wafer fabrication plants require very pure water). Today, reservoirs, drains, sewers, water reclamation plants, and desalination plants are all part of a seamless self-sustaining water loop that meets the city's needs.

Foreign companies that set up business in Singapore are an important part of the economy. However, the industrial land they require is in short supply. Therefore, JTC Corporation, the national

industrial land developer, created several cutting-edge industrial infrastructure solutions. One example is the "stack-up" and "ramp-up" factories that are a unique space-saving solution for business parks, enabling better use of space and facilities in Singapore. Another idea is the clustering strategy whereby supporting and related industries are clustered and developed on the basis of shared core capabilities and infrastructural facilities. Knowledge parks, such as the 200-hectare one-north development, have research and development offices (for biomedical sciences, life sciences, and engineering, among others), as well as residences and shared entertainment facilities. One of the bolder "land creation" projects that JTC took on was creation of Jurong Island from reclaimed land for the petrochemical industry back in the 1990s.

Waste disposal is a common problem in densely populated cities. With no more room on the mainland to accommodate landfills, Singapore created the offshore Semakau island landfill in 1999. While doing so, every effort was made to protect the existing marine ecosystem on the island so that Semakau today is amazingly both

a landfill and a leisure destination for the city's nature lovers and stargazers.

Creating innovative urban solutions does require an investment and commitment to R&D. For instance, Singapore's water agency committed \$20 million for R&D in 2010. On a larger scale, the National Research Foundation committed \$330 million for R&D at the Environment and Water Industry Development Council from 2007 to 2012.

Policies and Programmes

Examples

- The National Research Foundation provides strategic direction for the city's research and development (R&D) efforts and provides funding to relevant R&D projects.
- Government agencies and universities pursue sector-specific research, for example, in the area of water technologies, sustainable urban development, and clean technology.
- Development of unique knowledge parks, such as one-north, has supported the city's R&D activities.

S\$400mn

funding for R&D on Urban Sustainability Research and Development including S\$ 50 mn fund under MND Research Fund for the Built Environment.¹

S\$11.7mn

Funding support to National Research Fund—3.4% of the PMO's total expenditure for FY2012²

R&D investments proposed for 2012-15 at S\$16.1bn under the Research, Innovation and Enterprise (RIE) 2015 plan³

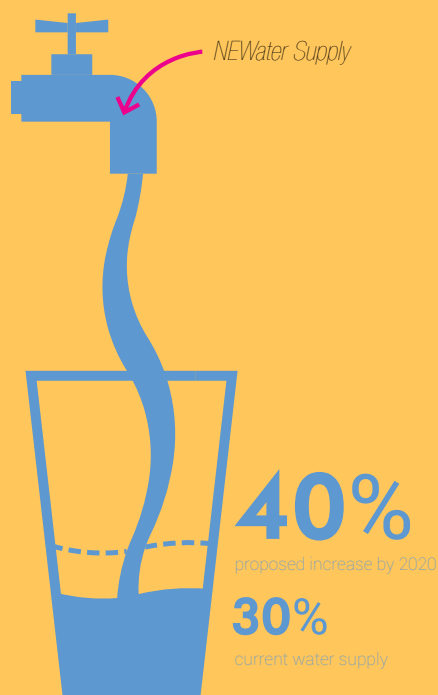
Proposed share of R&D investments in total GDP: 3.5% by 2015⁴

1,500 – 2,000

Number of patents filed worldwide each year as a result of R&D conducted in Singapore (9% applications from local based companies)⁵

696

patents granted to Singapore in 2011⁶



Strategy

- Embrace innovative and nonconventional solutions to address land and resource constraints.

Actions

- Invest time and money in developing or customising urban systems to suit the needs and geography of the city and allow for greater density.
- Put in place policies and incentives that encourage innovative solutions which allow for more land uses to coexist.

Outcome

- City-specific and customised urban solutions that lead to an efficient and sustainable use of limited land and resources.

Challenges

- Lack of coordination between research institutes and business enterprises.
- Difficulty in attracting and retaining talented manpower for R&D.
- Lack of supportive institutional frameworks and inadequate R&D investments.

Sources:

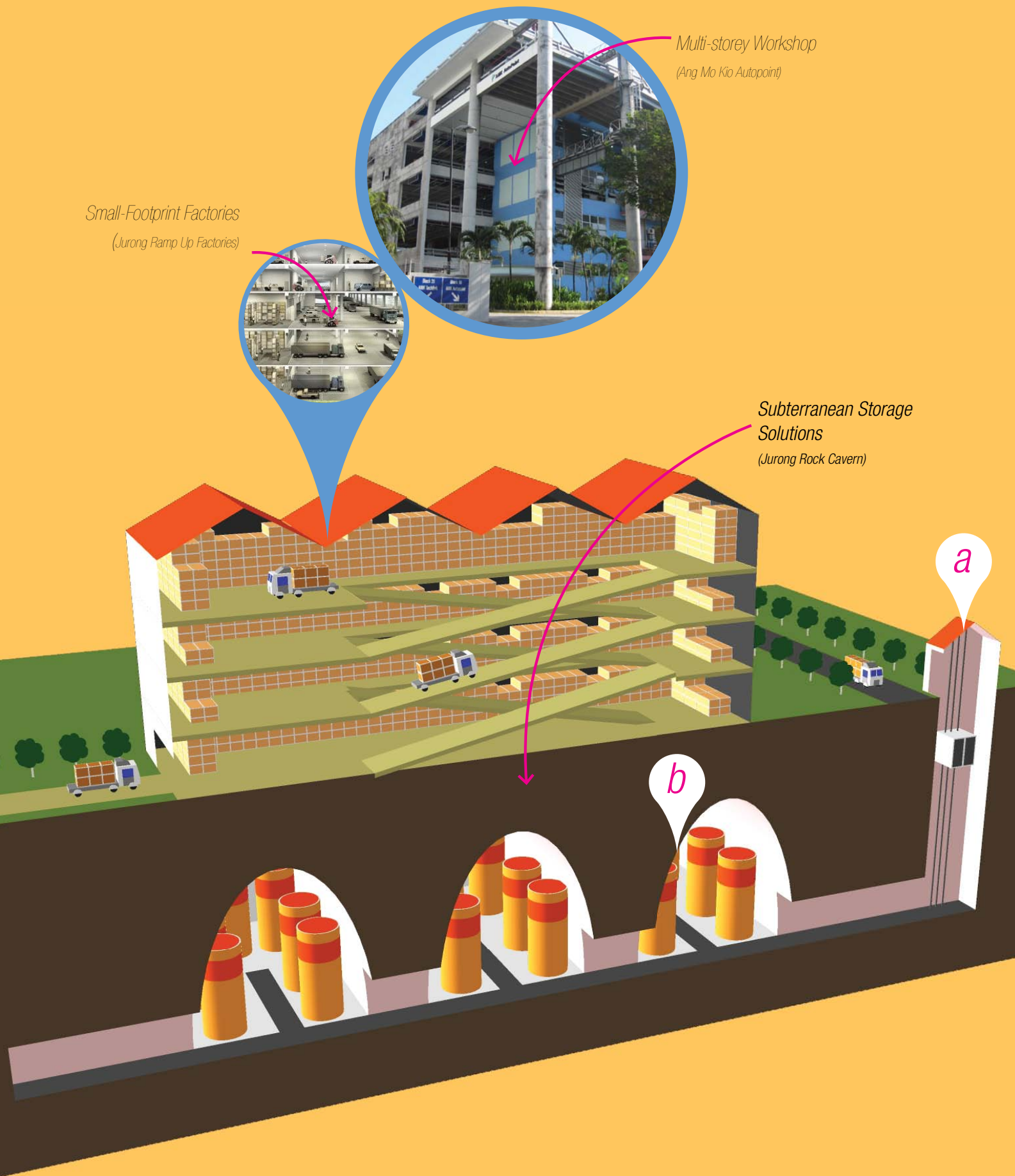
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5. Wong, T. (August, 2012). Up to 2,000 Patents filed yearly from Singapore research. Straits Times. Retrieved from <http://www.straitstimes.com/>
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a



b



Innovation Below and Above Ground

Challenged by the limited land in the city, many industries sought alternative spatial solutions to be able to operate more effectively. Underground facilities were developed for mass storage while production lines were redesigned to work within space-saving vertical factories. *Photo courtesy of JTC (Rock Cavern), Far East Organization (Small Footprint Factory) and HDB (Multi-storey Workshop).*



Tourists and locals along Orchard Roads' boulevard lined with trees, street furnitures and thematic decorations. Photo courtesy of Rodeo Cruzado Cabillan.



10

Forge **3P** Partnerships

Managing the interests of groups advocating different ways to develop or not develop the limited pool of land in the city is an important part of any city government's work. More likely than not, land parcels are near one another and the effects of development in one area will be felt quickly and acutely in neighbouring sites. Therefore, the city government and all stakeholders need to work together to ensure that they are not stepping on one other's toes and taking actions that would reduce the quality of life for others. In the best-case scenario, there is a collective responsibility towards the precinct or neighbourhood.



Civil society groups took an active interest in the conservation and potential development of the land where the railway tracks that linked Singapore and Malaysia once lay. Photo courtesy of SengkangBabies.

People, Private, Public

Singapore has created several people, private, and public (3P) partnerships to work on finding the best use of its limited land, leveraging the skills, resources, and expertise of the stakeholders. Where there are conflicting interests, the partnerships are a way to find mutually acceptable win-win solutions so that the resulting project can be implemented smoothly and with as wide support as possible.

An example of 3P partnership is the Orchard Road Business Association (ORBA), which aims to get more people to visit Orchard Road and patronise the businesses there. It engages in several business development, promotion, and marketing activities. The popular Christmas Light-Up @ Orchard is a signature annual event. Several government agencies also worked closely with OBRA to improve the infrastructure, design, and look of Orchard Road to give shoppers and tourists a better experience.

More recently, Singapore's Urban Redevelopment Authority (URA)

formed the Rail Corridor Consultation Group to get the public sector agencies to engage with members of civil society who had an interest in how the land that once was the railway route through Singapore (from Tanjong Pagar at the southern end of Singapore to Woodlands in the north) would be developed.

The Singapore River ONE (SRO) partnership started off as a pilot project by URA to get the various stakeholders to feel a stronger ownership of Singapore River so that social and economic activity in the precinct would be developed in a coordinated and sustainable manner. The group has representatives from the government (URA, Singapore Tourism Board, National Arts Council, the police), civil society (Consumers Association of Singapore, the Singapore Kindness Movement), and the businesses located in three quays along the river. It coordinates policy regulation and enforcement for the area and also works on the signage, shop fronts, and outdoor refreshment areas along the river. The partnership has made the Singapore River a lively area for leisure and business.

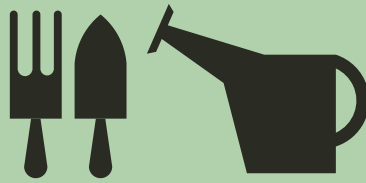
Policies and Programmes

Examples

- Various 3P groups, including the Rail Corridor Consultation Group, Orchard Road Business Association, and Singapore River ONE, have forged partnerships between the public and private sectors and with the community.
- The various 3P programmes of the National Environment Agency, which include Clean and Green Week, the Environment Champions, the 3P Partnership Fund and various school-based activities, engage the community in keeping the city "clean and green".

300

active gardening groups under the the Community in Blooming programme started in 1995. ¹



20

successful ABC Waters projects ²

100

ABC Waters proposals identified for implementation over next 10-15 years ²

Strategy

- Look to the private sector and civil society as partners rather than adversaries.

Action

- Actively seek to form 3P partnerships to obtain good ideas for a development or redevelopment project, manage potential tension among different interest groups, and build stakeholder support.

Outcome

- Sharing by the government, the private sector, and the public of tasks and resources to ensure that developments add to the liveability of the city.

Challenges

- Many government agencies are in the early stages of community engagement and forming 3P partnerships and thus lack experience and expertise.
- Building trust among the stakeholders takes time.

Sources:

- 1.NParks. (n.d). Community In Bloom. Retrieved from <http://www.nparks.gov.sg/>
2. Public Utilities Board. (n.d).ABC Master Plans. Retrieved from <http://www.pub.gov.sg/abcwaters>

Orchard Road Urban "Layers"

The success of Orchard Road as a prominent and vibrant commercial district is based on a strong partnership among the stakeholders in the public and private sectors.

The Orchard Road Development Commission (ORDEC), composed of the Urban Redevelopment Authority (URA), Singapore Tourism Board (STB), Economic Development Board (EDB) and Land Transportation Agency (LTA), looks at new and innovative ideas that will add value to existing developments. Waivers and incentives are given for projects that aim to rejuvenate street blocks in the area. Some of the past projects include facade facelifts, the building of underground connections, design of the pedestrian streetscape and general landscaping.

The Orchard Road Business Association focusses on making the area more vibrant and creating unique experiences, such as festive events like Fashion Steps Out @ Orchard, Rev up @ Orchard, and Christmas Light Up @ Orchard.

The Butterfly Trail is a unique project on Orchard Road. The Nature Society of Singapore (NSS), National Parks Board (Nparks) and other private sponsors are developing five butterfly trails in phases. Planting activities that green the area are held periodically by different associations, students and private company employees.



*Innovative Facade
Redevelopment Projects*

Photo courtesy of Rodeo Cruzado Cabillan (Orchard Road Malls, Tunnels and Sidewalk) and Anuj Jain-Nature Society Singapore (Butterfly Trail).

a

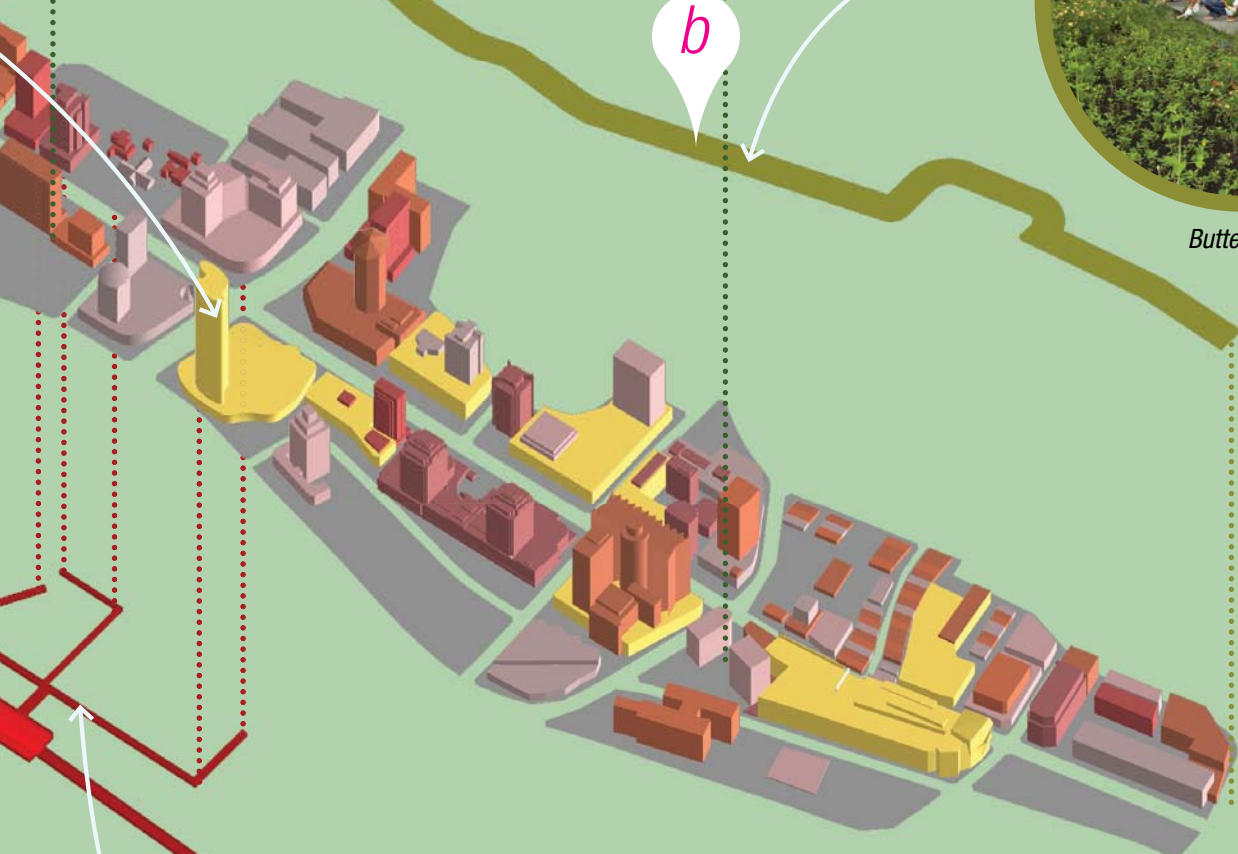


Street Thematic Lighting, Planting and Furnitures

b



Butterfly Trail



Underground Connections

Challenges and Conclusion

The ten principles provide an insight into Singapore's integrated model of planning and development, which weaves together the physical, economic, social, and environmental aspects of urban living. Many of the impacts of high-density city living can be mitigated or managed better through such an approach. For Singapore this is an important factor as the country continues to grow and high-rise buildings increasingly dominate the urban landscape.

In the workshops, the question "How dense is too dense for Singapore?" was often raised, and issues that are starting to occur in denser neighbourhoods were discussed. Given the finite land mass, could Singapore support a higher population and still be highly liveable? In such an environment, how would the city address challenges such as the negative impacts occurring around highly populated mixed-use developments that create tensions among residents, workers, and visitors? Are there better methods for recycling land and creating buildings that can stand for longer periods of time? What strategies are needed for managing the social tensions that come with the more diverse population needed in a competitive economy? How can the urban infrastructure support system sustain a larger population while maintaining Singapore's economic dynamism, protecting environmental quality and biodiversity, and providing a safe, healthy, and comfortable living environment conducive to building cohesive communities?

The ten principles provide the foundation to develop more ideas on how Singapore can support a larger, denser population without sacrificing quality of life. In fact, the principles are not applicable only to Singapore. For instance, very dense cities like New York City, Brussels, and Osaka have relied on 3P partnerships to manage the use of space. Hong Kong planners design areas with a view to increasing safety and personal security. London and New York City have dense and diverse populations, and both are centres of innovation and creativity.

Studies indicate the inevitability of cities becoming more densely populated and built up.¹ For the new cities that are forming and older cities that are being redeveloped, CLC and ULI hope these ten principles can be a starting point for city planners, developers, and dwellers, triggering ideas about how they want their city to evolve and be shaped. It is also hoped that this report shows that creating a highly dense yet liveable city, while not easy, is possible—and the proof is in the fact that it has been done successfully before.

1. According to the United Nations, the world's urban population, estimated at 3 billion in 2003, is expected to rise to 5 billion by 2030. In some countries, the share of people living in urban areas has continued to increase, in some cases as a result of population density in intermediate regions rising until they become fully urban (especially in Japan and Italy, but also in Belgium and Canada). OECD 2006.

Appendix

Annex 1: Four Case Studies

As a prelude to the CLC/ULI study, the team studied four distinct districts of Singapore that are highly dense and highly liveable. Through these case studies, the team assessed the development strategies, economic and social mix, and other characteristics of these districts to determine the factors that have made these high-density places also highly liveable. The case studies looked at the planning frameworks that enabled the development of these sites and the resultant socio-economic impact.

The following sites or districts were chosen:

- Marina Bay and Raffles Place;
- Orchard Road;
- Tampines; and
- Toa Payoh.

Following are summaries of the framing of the four case studies.

Marina Bay and Raffles Place: An integrated development on the waterfront and the revitalisation of the central business district (CBD)

About Marina Bay and Raffles Place

Marina Bay is an example of a high-density, high-liveability space achieved through mixed land use, establishing an integrated resort (IR) as well as a national park named Gardens by the Bay. The development is envisaged as the new, high-population downtown, operating 24/7 based on the live/work/play concept, meaning that it combines business, residential, and leisure components and merges the traditional role of the CBD with high-end urban tourism and entertainment. It is planned so that it does not become a dead zone after work hours.

Marina Bay complements the CBD's function in providing high-end financial services and attracting international business travellers and activities. This enhances Singapore's role as a gateway for activities in the meetings, incentives, conventions, and exhibitions sector, as exemplified in Suntec City's convention space and the new convention facilities at Marina Bay Sands. The redevelopment of Marina Bay as a high-density, high-liveability space is part of Singapore's drive towards becoming a knowledge-intensive economy and a global city. Singapore aims to both achieve economic growth and raise the general standard of living. This strategy reflects Singapore's efforts to match the reinvention of global cities such as New York City, London, and Paris.

Brief development history

From 1969, 360 hectares of land was reclaimed from the sea to provide additional prime sites adjacent to the existing CBD centred on Raffles Square and Shenton Way. This area formed Marina South and allowed the longer-term expansion of the CBD. For a decade from 1977, the cleanup of the Singapore River, which ran northwest of the bay, culminated in the removal of polluted water, relocation of pig farms, and rehousing of shop house residents to public housing flats. This transformed the role and identity of the river and had huge implications for the bay.

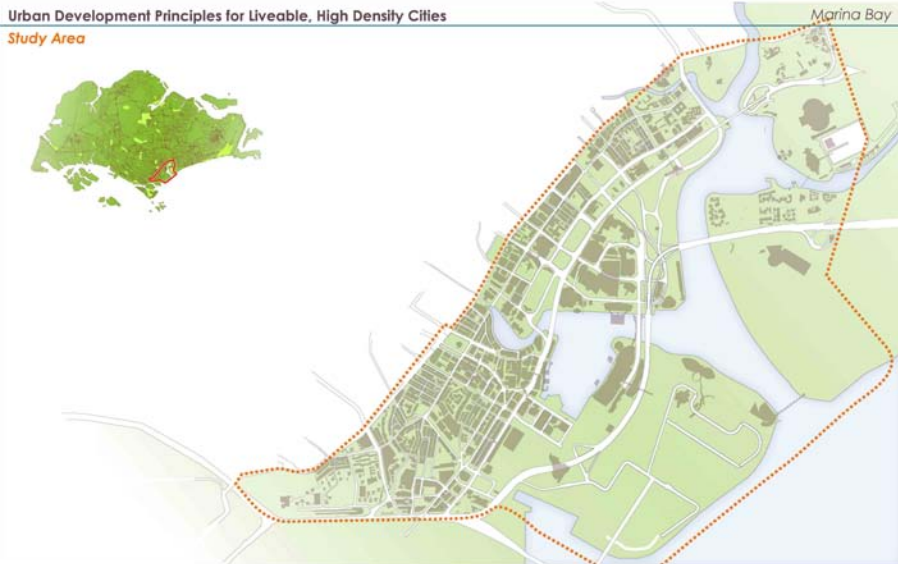
In the late 1980s, in the ongoing review of the Concept Plan, recommendations were made to encourage a mix of office and commercial buildings, parks, medium- to high-density housing, and open spaces along the waterfront to rejuvenate the central area. In the 1991 revised Concept Plan, the Marina Bay area was planned for shopping and low- to medium-density commercial use. However, the response from the private sector was lukewarm, particularly after the 1997 Asian financial crisis.

In 2003, the Economic Review Committee recommended flexible land use planning in the city centre, allowing bigger pieces of land to be used for integrated, phased development, including the creation of an Integrated Business Financial Centre located between Marina Bay and Collyer Quay, which would double Singapore's existing office space. This proposal included redeveloping Marina Bay into a space combining financial and leisure activities within the CBD. In 2004, a state-led initiative was announced to build an IR at the bay. The IR was intended to be a source of public revenue and to rejuvenate Singapore's tourism industry (which since the 1990s had lagged behind those of neighbouring countries). The IR plan sought to reconcile the tension among economic, social, and environmental sustainability and to ensure that the economy grew in tandem with environmental and social interests, for example, the carrying capacity for the influx of tourists and residents, and the increased consumption of fuel and water resources. More important, the plan had to address the social impact of the IR and to ensure that the long-term sustainability of Singapore as an urban social unit was not compromised.

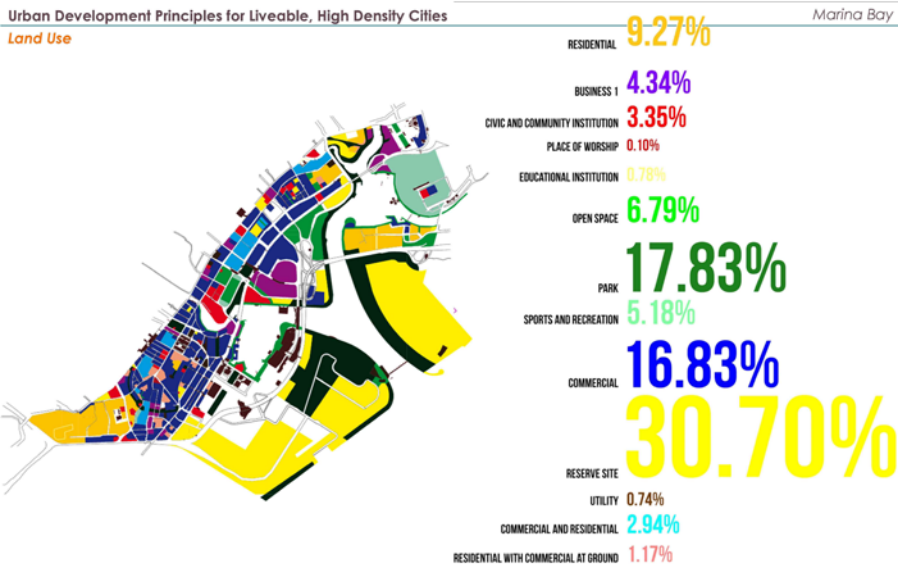
Planning framework

To facilitate the development of Marina Bay as a 24/7 live/work/play precinct, the Urban Redevelopment Authority's "white-site" land use zoning was formally introduced for land in Marina Bay to allow developers and investors greater autonomy and flexibility in deciding the most appropriate mix of uses for their land parcels. The concept of white sites

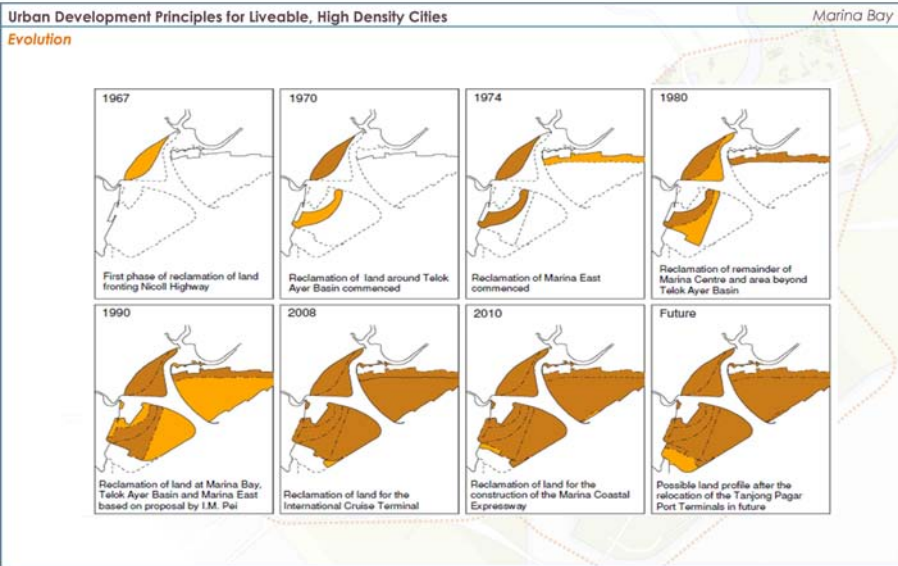
Study Area



Land Use



Evolution



allows flexible mixed land use instead of traditional fixed-use zoning, which enables development of the right mix of housing, commercial uses, hotels, and recreational and community spaces. The urban grid framework, extending from the existing city grid, ensures good and complementary connectivity to and from the city. The grid framework also allows creation of parcels of land of varying sizes, determined in consultation with the private sector to ensure sensitivity to market demand. The bay was intended to add to and complement existing and planned development zones nearby: the arts/cultural space at the Esplanade, the shopping/office/hotel hub at Marina Centre, the proposed Sports Hub in Kallang, and the water supply/flood control space at the Marina Barrage.

Development strategies

Besides the white-site strategy, land in Marina Bay was parcelled to provide flexibility in development options. This flexibility proved very useful when larger parcels were needed later for the development of the Marina Bay Financial Centre and the Marina Bay Sands IR.

To ensure a high-quality environment for businesses as well as to encourage people to work and live there, urban design guidelines were created to maximise views of the bay; provide convenient pedestrian access between buildings and public amenities through an integrated network of at-grade covered pedestrian walkways, below and above ground; and provide extensive greenery through Gardens by the Bay, sky terraces, and roof gardens.

Infrastructure

Because Marina Bay comprises mainly reclaimed land, for development to take place, infrastructure had to be planned and put in place ahead of time. The Singapore government has, to date, pumped in about S\$8 billion worth of state-of-the-art infrastructure to ensure the smooth functioning of the precinct.

One such example is the Common Services Tunnel (CST), the first to be implemented in Southeast Asia. The CST is a comprehensive underground

tunnel network that houses telecommunication and utilities for distribution to all developments in Marina Bay. The CST network also houses the District Cooling System, which pipes chilled water to all developments in Marina Bay for air conditioning and thus removes the need for buildings to have individual cooling towers. Underground space is thus maximised, and traffic disruption is minimised without needing to dig up roads and service verges for repairs or upgrading of service lines. Future changes in demand for utilities and services can be catered to more easily by installing more cables within the CST.

New underground mass rapid transit (MRT) stations and a new road network, including the new Marina Coastal Expressway, will provide greater accessibility and connectivity to the rest of the island.

Orchard Road: More than a shopping street

About Orchard Road

Orchard Road is still Singapore's main shopping street, although many different shopping areas have sprung up recently to challenge its supremacy. One of the features of its continued attraction is its ability to change and remain relevant to Singapore's urban culture. The current remaking of Orchard Road is an example of an initiative to keep Orchard Road attractive. It is based on a people-centric planning framework that provides for a variety of immersive, streetwide day/night activities and experiences that appeal to diverse segments of the population.

Although perceived primarily as a shopping street, Orchard Road also serves its surrounding neighbourhoods, such as Tanglin, Cairnhill, and Oxley Rise, apart from its "resident" population ensconced within its numerous hotels. Orchard Road is both global and local in its reach and is the site of formal and informal economies. Orchard Road is not merely a street people walk through to reach the malls: it aims to be a destination like other great streets in the world.

Development history

Historically, Orchard Road did not develop according to a master plan but through piecemeal changes in response to the overall growth of the population and economy. Starting in the 1830s, the road served the nutmeg plantations and pepper farms, and the residential enclaves on Scotts and Tanglin Roads, which eventually replaced the plantations and farms. Early Orchard Road served its neighbouring residential areas, with the establishment of shop houses, Koek's Market, the Cold Storage store, and motor vehicle workshops. The first department store, C. K. Tang, was set up in 1958.

The street continued to be flood prone until the building of the Stamford Canal in the 1960s. By the 1970s, it had replaced High Street as the city's main shopping venue. The opening of Lido Cinema, Raffles Village, a car park that transformed into an open-air food court at night, and Jackie's Bowl (bowling alley) in the 1960s and 1970s made the street a local entertainment strip. The 1970s also saw the opening of the Mandarin Hotel and Plaza Singapura (mall) and the implementation of the Orchard Road Pedestrian Walkways in 1976, a state project that provided wide walkways for shoppers—and perhaps the first attempt at defining an image of Orchard Road as a shopping street. In the 1980s, shopping podiums and towers, such as the then Dynasty Hotel, replaced many of the double-storey shop houses. With the opening of the three MRT stations in 1987, the concept of Orchard Road as a retail corridor that stretched all the way south to Marina City was born. Large, self-contained shopping malls, such as Ngee Ann City, populated the corridor. They offered not only space for shops and restaurants, but also public functions such as a library, a post office, and a civic plaza. At the turn of the millennium, Orchard Road had acquired all the trappings of a globalised shopping street, with bright lights, video walls, a cosmopolitan crowd, and several al fresco kerbside cafés.

Economic space

The retail landscape of Orchard Road is continually renewed with

the addition of new malls or the refurbishment of older malls. Orchard Road is able to appeal to different crowds—whether they are Singaporeans, expatriates, or tourists, and whether they are interested in high-end shops, family-oriented outlets, designer boutiques, or lifestyle services. Besides the shopping malls, the presence of cineplexes, spas and fitness centres, and bars, pubs, and clubs complements the Orchard Road experience. Also available is a wide mix of dining options in terms of cuisine (Western, Asian, international, vegetarian, and others) and types of establishment (hotel-based businesses, fast-food outlets, bars and cafés, and food courts). Hotels include high-end international chains, boutique hotels, and midrange accommodations.

The formation of the Orchard Road Business Association (ORBA) in 1998 helped integrate and strengthen the business community in the area and promote street-wide activities. The ORBA has organised "twinning activities", for example, "Twinning Festivals" that showcase the goods, attractions, and activities of Orchard Road and of another great world street. In 1999, after discussions with the then Ministry of Information and the Arts and the police, deregulation allowed street performers and buskers. Other street activities include portrait painting, exhibitions, and open-air concerts, while ice-cream sellers on motorised carts sell their wares along the sidewalks.

Social space

Orchard Road can be conceived of as four distinctive areas that shape the social spaces of the street:

- The Terraces. Between Tanglin/Orange Grove and the Scotts Road junction is an area with a high concentration of tourists, hotels, and outdoor refreshment areas and without large shopping complexes. The "terraces" refer to the raised and sunken platforms fronting the buildings, which are often occupied by outdoor cafés.
- The Walk. Between the Scotts Road junction and the Grange Road junction, including the Orchard MRT station, is the busiest part of Orchard Road

Study Area



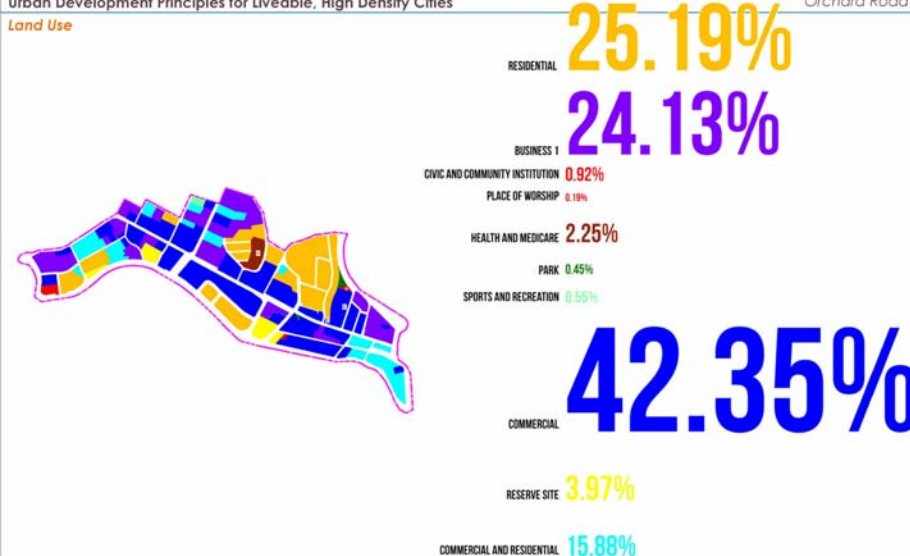
with numerous malls, wide pedestrian sidewalks, and outdoor refreshment areas. Atriums make up for the lack of shop fronts. The area in and around Lucky Plaza is a longstanding favourite gathering area for Filipina domestic helpers on Sundays.

- Somerset. Between the Grange Road junction and Istana Park, the street narrows (from 50 to 30 meters) and includes conservation areas such as Emerald Hill and Cuppage Terrace. The locale has many small lanes, which are ideal for development into thematic retreats for a more intimate pedestrian experience. Discovery Walk, a new sheltered pedestrian mall over the Stamford Canal, links Orchard Central with 313@Somerset malls as well as other developments in the area. Youths gather near and around the Somerset MRT station, with nodes such as the *scape skate park, youth centre and youth park, the Heeren, and Cineleisure Orchard, especially on Friday nights.

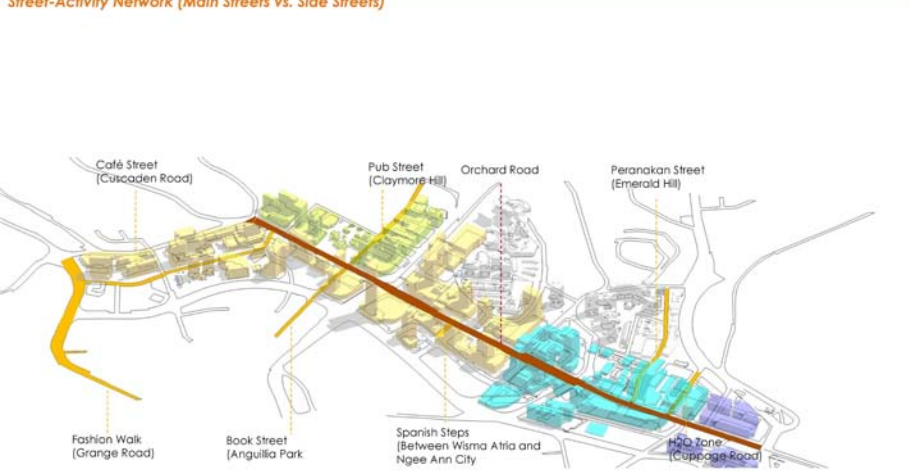
- Dhoby Ghaut. Between Istana Park and the beginning of Bras Basah, this area includes the Dhoby Ghaut MRT station and interchange, the nodal point of a large network of interconnecting transportation systems (such as the MRT Circle and Northeast Lines). It has underground pedestrian connections and commercial outlets and forms a virtual underground city. But the area also boasts many colonial-era buildings and has a more genteel feel. Other development initiatives include vibrant side streets, each with its own special character, such as Peranakan Street (heritage; Emerald Hill Road); Café Street (Cuscaden Street); Book Street (Angullia Park); Pub Street (Claymore Hill); Spanish Steps (between Wisma Atria and Ngee Ann City); H2O Zone (Cuppige Road); and Fashion Walk (Grange Road).

Aside from social spaces, year-round events help define Orchard Road. These include Fashion Steps Out @ Orchard (March); Twinning Festivals (March); Great Singapore Sale (June/ July); Christmas Light-up (December); Revellers' Night (New Year's Eve Street Party); Arts Events (including Singapore Arts Festival, March/ September); Comedy Festival (April); World Market Place (September/

Land Use



Street-Activity Network (Main Streets vs. Side Streets)



October); and Music Fiesta (October/November), among others.

Environmental space

One of the unique features of Orchard Road are the large Angsana trees flanking the street around the Orchard MRT station that provide lush shade and attract birds so they remain an important part of the urban ecology. Although little known to many, a butterfly trail leads from the Botanic Gardens to Fort Canning Park.

Orchard Road is a busy thoroughfare for both vehicles and pedestrians, with good connectivity to the Civic and Cultural District and Marina Bay. Although electronic road pricing gantries along the road regulate vehicular traffic volumes at different times of the day, the street is well served by public transit, with three MRT stations and numerous buses plying Orchard Road as well as the parallel Somerset Road.

Along the street, underground as well as street-level arcades connect buildings and spaces. Through offering incentives on gross floor area for outdoor refreshment areas, several buildings have incorporated urban verandas, providing a new dining experience. Incentives for having articulated facades have also encouraged opening up of mall shop fronts for more street-level activities, as well as the creation of interesting three-dimensional facades through the face-lifts of existing buildings.

Tampines New Town: An urban regional node

About Tampines New Town

Tampines New Town is the institutional, social, recreational, and commercial hub of the eastern part of Singapore. Among the new towns in Singapore, Tampines is distinctive in pioneering the regional town centre and green corridor concepts, and it is characterised by distinctive neighbourhoods and apartment blocks. It is an example of high-density, high quality, and affordable housing for Singaporeans. It has high-rise housing, a comprehensive range of amenities, and community and green spaces. In 1992, the new town won the United Nations (UN)

World Habitat Award for Excellence in Housing Design (Developed Country Category).

Development history

Originally a fishing village and then a quarry area, Tampines is Singapore's first regional town centre and is now the country's largest new town. In the 1970s, the first building work started towards housing a population capacity of 200,000 people in 52,000 Housing and Development Board (HDB) flats. The resettlement program took ten years. In the process, 1,078 hectares of land was cleared, and 3,720 villagers were rehoused. The flats were built using prefabrication, enabling an apartment block to be constructed in 33 days, which was impossible with traditional methods. Tampines New Town was also the first to be developed using HDB's new town planning precinct concept; the first precinct was built in 1978. Although conceived as a planning scheme with social affordances, the precinct concept, with the use of multistorey car parks, also allowed flexibility in the provision of open spaces for each precinct and configuration of blocks to separate human and vehicular traffic.

Note: Estimated size and population density of Tampines New Town as of 2009: 11,800 persons per square kilometre (km) (246,561 persons living in a 21-square-km area).

Environment and planning framework

Self-contained and well-provisioned, Tampines New Town has a wide range of community, health, educational, and recreational facilities. These include a library, a polyclinic, four community centres, a Central Provident Fund (CPF) building, places of worship for various religious groups, a stadium, a sports hall, a swimming complex, three large parks, and a recreational club. The town also has several primary and secondary schools and tertiary institutions. In addition, three shopping malls have been built, containing various restaurants, supermarkets, department stores, cinemas, bookstores, and other retail outlets. Large mega stores located off Tampines Expressway cater to residents on the eastern side of the island. Tampines has an

efficient transportation network of expressways and trunk roads, an MRT station along the East–West line, and a bus interchange with feeder bus services. It is well served by Tampines Expressway, Kranji–Paya Lebar Expressway, Pan-Island Expressway, and East Coast Parkway.

When Tampines was conceived, avoiding architectural monotony in HDB public housing blocks was deemed particularly important in planning a high-density town. Thus, Tampines New Town has staggered, curved, and angled blocks of various heights, creating a picturesque and interesting skyline, with variations in the block design and internal layout. Prior to 1991, the management and maintenance of the towns was the sole responsibility of HDB. As of 1 March 1991, much of this responsibility was passed to the newly created Town Council. The Town Councils were introduced as a means of encouraging residents living in each estate to take more responsibility for their homes and environment.

Another unique feature of Tampines New Town is that instead of being encircled by a green belt, it has green areas in the town centre itself, using the green connector concept. The green corridor weaves through the precincts and links them to the park and neighbourhood centre. The corridor has been successful in creating open and green community spaces and has been adopted in other new towns and older HDB estates that are being upgraded.

Economics

As one of three regional centres in Singapore, Tampines was planned as a business and financial centre for the eastern region. As such, developments such as housing, commercial centres, and business parks are well integrated with transport nodes and other infrastructure, capitalising on Tampines's proximity to Changi International Airport. Although research has shown that a significant proportion of those working in the Regional Centre are not from the region, the connectivity of Tampines Regional Centre to other parts of the island supports its economic sustainability; however, closing rent gaps with the CBD area

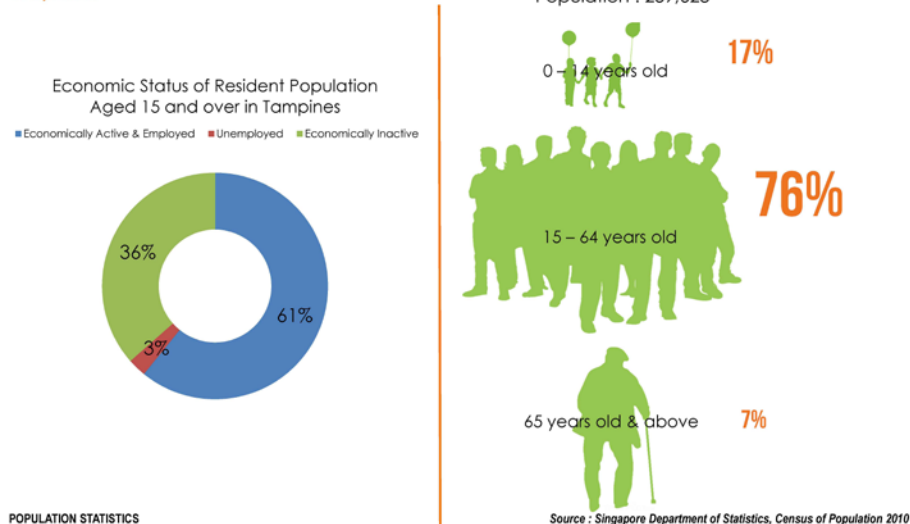
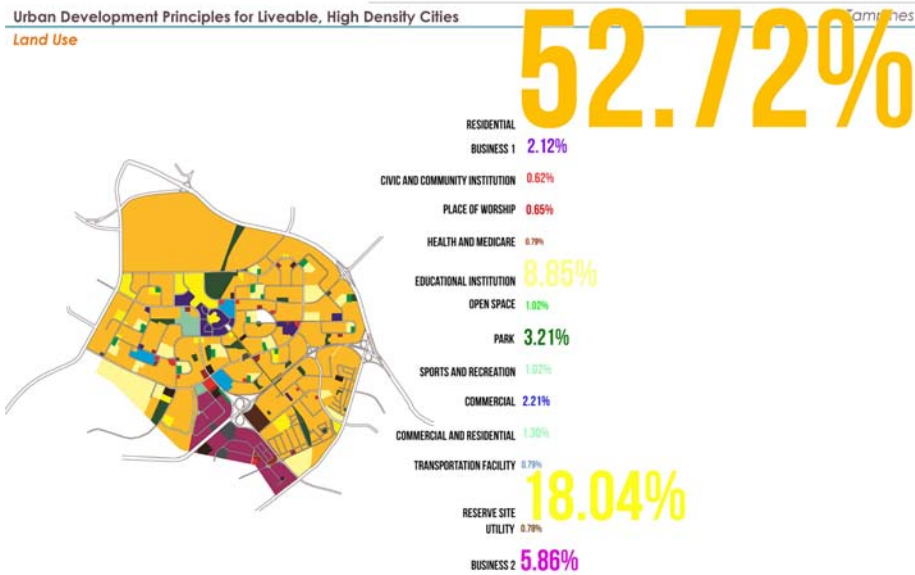


will be a potential challenge¹. The recent addition of more residential development options in Tampines may potentially alter work/live patterns in the areas². The Regional Centre attracts shoppers from other parts of the island, thereby affecting shopping in the downtown areas.

Social sustainability

Each housing block has flats of different sizes, bringing together households of different income levels and social backgrounds. This prevents the aggregation of low-income groups in one block, which may result in the creation of ghettos. In some areas, the void decks house education and community facilities such as child care centres and kindergartens. The apartment blocks are organised into clusters, each of which has an open space, called the precinct centre, which breaks up the physical and demographic density. With a network of landscaped walkways and footpaths leading to it, the precinct centre is conceived as the focal point for residents' social and recreational activities.

The Home Ownership Scheme was firmly established by the time Tampines New Town was built. With flats financed through the CPF as well as HDB loans, the high homeownership in new towns and the efficient maintenance regime have supported the sustained value of flats as homes as well as economic assets. Robust upgrading programmes bring older precincts up to par with those of newer estates and keep the stock of housing in good repair. As of 2011, Tampines is regarded as a high-end estate with above-average market value.



1. Lai-Choo Malone, "Work-Travel and Shopping Patterns in the East Region of Singapore," National University of Singapore, Department of Real Estate, research project, year unknown.
2. Ibid.

Toa Payoh New Town: Intensification and revitalisation of Singapore's first new town

About Toa Payoh New Town

Toa Payoh is a planned new town which offers high-density, high-quality, and affordable housing for Singaporeans through the provision of high-rise housing and a comprehensive range of amenities. As an "old" new town originating in the 1960s, Toa Payoh illustrates how high-density living is sustained and developed through renewal processes. Two forms of renewal exist: town renewal and HDB housing upgrades. The Lorong 5 precinct in Toa Payoh is a good example of high-density living rejuvenated by state-subsidised upgrades in the 1990s.

The town renewal program in Toa Payoh, the first in Singapore, aimed to address new housing needs, ensure that old housing remained viable, provide facilities suitable for an ageing population, achieve a higher quality built environment, make better use of the available land, and allow residents to retain their ties with the community they live in. The project was a finalist in the 2004 UN World Habitat Awards.

A significant problem faced in the ageing new town was the outmigration of children of residents to younger new towns with better and more attractive facilities. As a result, the town has greyed significantly, such that of its 36,000 flats in 2004, 17,000 have elderly occupants, either living alone (6,000) or with a family (11,000).

Brief development history

Toa Payoh, located at the margins of the central area, was Singapore's second new town after Queenstown. Prior to public housing development in the 1960s, the area was covered with swamps and inhabited by villagers engaged in vegetable growing and livestock husbandry. Resettlement began in 1962 through land acquisition. On its completion, Toa Payoh housed 200,000 people, or one-tenth of Singapore's population at the time. The figure has been revised upwards many times since.

From the onset, Toa Payoh was conceived as a high-rise new town. It originally had 12-storey blocks, which were typical of the housing built in the 1960s. Renewal and intensification have changed the face of Toa Payoh to include buildings of 30 storeys that command views of the island, with a nod to the town's proximity both to the city and to the greenery of the MacRitchie Reservoir.

The town renewal program for Toa Payoh was launched in 2004. Components of renewal included house and lift upgrading, improved living conditions for older people, sale of some sites to encourage greater diversity of tenure, renewal of the town centre, provision of new community facilities, and improvement of the road networks. Upgrading works benefited older people and those with physical disabilities (e.g., wheelchair access, lower control panels on lifts, support rails, nonslip flooring, and alarm systems). Four new community centres were built, equipped with new facilities such as cafeterias, reading rooms, dance and music studios, and a community library.

Note: Estimated size and population density of Toa Payoh as of 2009: 17,500 persons per sq km (142,786 persons living in an eight-sq-km area).

Environment and upgrading

The new town is a self-sufficient living space that is well served by shopping facilities as well as high-density commercial and office developments such as the HDB Hub. Toa Payoh also has a comprehensive public transportation network in the form of a bus interchange with feeder bus services and the Toa Payoh MRT station on the North–South line. The new town has a number of primary and secondary schools, as well as tertiary institutions. It also has several community centres, a recreational club, a community library, and places of worship for various religious groups. There are several major health facilities in the town, including RenCi Hospital and Medicare Centre, and Tan Tock Seng Hospital nearby in Novena. The new town boasts comprehensive sports and exercise facilities, such as a stadium, an indoor sports hall, a large swimming complex, and the garden-

landscaped Toa Payoh Town Park at Toa Payoh Central.

Upgrading was done on block facades, common corridor flooring, lifts, and common areas. After its upgrading, Lorong 5 was given a new name, Toa Payoh Vista. It boasts the first 40-storey public housing block in Singapore. Environmental features were incorporated into the upgrading project, such as maximising use of natural ventilation and lighting, and collecting and saving rainwater. The success of the upgrading project shows in the residents' high satisfaction levels: an overall 97.7 per cent satisfaction rate (with accessibility to the town centre being ranked highest).

Economics

The large industrial estate planned as part of the new town was an intrinsic part of Singapore's economic policy of providing jobs near homes. High-rise office buildings and the insertion of commercial land use in Toa Payoh have created a well-integrated new town where residents have work/live arrangements and enjoy more lifestyle amenities.

Social mix

The first HDB blocks built in the 1960s were typically between nine and 13 storeys high. In the 1970s came 25-storey point blocks. It was a bold and innovative move to rehouse existing owners in new, higher-density blocks through the Selective En bloc Redevelopment Scheme (SERS). Toa Payoh Towers at Lorong 2, built in 1995, is HDB's first 40-storey block constructed under this programme. Residents affected by redevelopment were moved collectively to the larger accommodation, which was within walking distance of their old flats. The old flats were demolished only after the new flats were completed to help ensure social and community continuity.

Toa Payoh today is a much-sought-after residential area because of its good mix of public and private housing as well as its proximity to the city. For the public housing component, a good mix of HDB flats is available, with a majority of three- and four-room flats: 35,415 (total); 1,170 (one room);

Study Area Location – Central Region

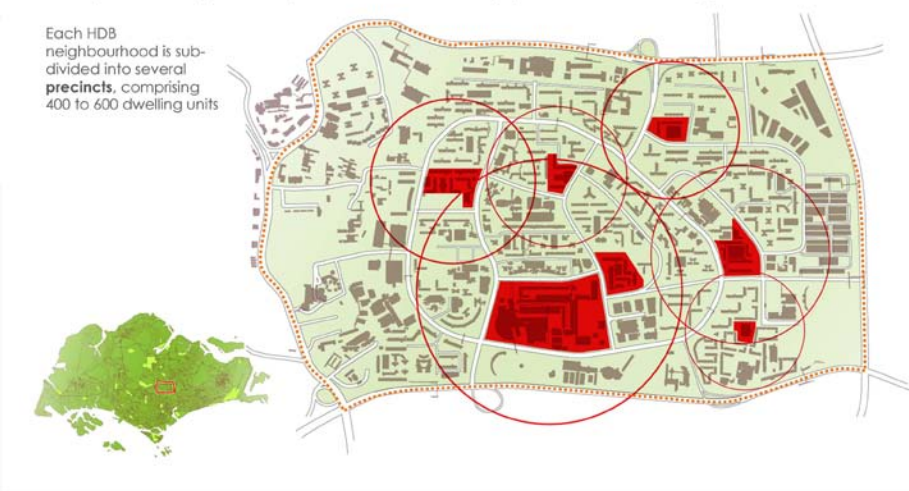


3,613 (two rooms); 14,913 (three rooms); 9,304 (four rooms); 5,213 (five rooms); 156 (studio apartments); 853 (executive flats); 175 (Housing and Urban Development Company flats).

Urban Structure

Toa Payoh is served by a hierarchy of commercial centres ranging from town centres to neighbourhood centres

Each HDB neighbourhood is subdivided into several **precincts**, comprising 400 to 600 dwelling units



Urban Structure: Open Space

Town Park
Neighbourhood Parks
Sports & Recreation Complexes



Annex 2: An Integrated Approach: Two Workshops

As part of the study on the ten principles of high density and high liveability, CLC and ULI jointly convened two workshops in Singapore, on 9 March 2012 and on 25 May 2012. A total of 62 people from the public sector, the private sector, academic and professional institutions, and civil society attended these workshops, 34 in the first and 38 in the second. The objective of the study and the workshops were twofold:

- Identify how liveability and sustainability are correlated to a city's high-density environment, based on Singapore's experience, and the context in which high-density can enhance a city's liveability and sustainability; and
- Distil the urban development principles for highly dense and liveable cities.

Workshop I

Agenda

The objective of the first workshop was to distil the broad principles that relate high-density developments to high liveability in Singapore. The discussions centred on the four case studies (see Annex 1) and were along the lines of three desired liveability outcomes: competitive economy, quality of life, and sustainable environment. The participants were divided into three groups for the breakout session. Each group was assigned one liveability outcome as the focal point for its discussion on the following questions:

1. What initiatives described in the four cases have contributed to the particular outcome?
2. How does high density contribute in terms of benefitting or challenging the particular outcome?
3. How will the outcome be affected if density were increased?

The discussions and findings of this workshop were then collated and analysed to identify some development principles that contribute to high density with high liveability.

Outcome

The collective brainstorming sessions of the first workshop identified many factors that contribute positively to high-density. The challenges of high density were also discussed. The table captures the key findings of the first workshop.

Following the workshop, the findings were refined into 24 urban development principles important in achieving the three outcomes (sustainable environment, competitive economy, and high quality of life). This set of principles included factors related to urban design as well as the often overlooked but intangible aspects of planning and governance. To ensure their direct applicability, these principles were expressed in an action-oriented rather than a conceptual manner. The principles were then discussed in the second workshop (see Workshop II for a list of the 24 principles).



First workshop discussions.

	High quality of life	Sustainable built Environment	Competitive economy
Positive contributions of high density.	<ul style="list-style-type: none"> • Social and cultural diversity leads to vibrant and interesting urban areas in the city, as well as innovation. • Diversity creates more options in the arts and cultural environment. 	<ul style="list-style-type: none"> • Compactness reduces travel distance; critical mass and clustering allow efficient public transport infrastructure. • Density makes walking feasible. Walking in mixed- use neighbourhoods allows cheap, sustainable ways of moving as well as familiarity with neighbourhoods. 	<ul style="list-style-type: none"> • Clustering enables access to markets, consumption, recreation, and business opportunities. • Opportunities are created for shared resources and land optimisation. • Clustering allows numerous B2B interactions. • Diversity in terms of people with differing intellectual diversity and multiple cultures stimulates creativity. • The scarcity of land forces social and urban innovations. • More people and high human traffic contribute to a secure and safe environment.
Challenges and trade-offs.	<ul style="list-style-type: none"> • Growing social tensions result from population influx, new demographics, an ageing population, and cultural adjustments to having less space because of smaller apartments. • A better modal split between public and private transportation modes needs to be achieved. • "Escapes", i.e., options to depressurise are needed if high-density becomes pervasive. • As density increases, the proliferation of private housing spaces leads to less shared public spaces and may lead to less vibrant street environments with an impact on safety. • As density rises, it exerts an upward pressure on land prices, which would affect affordability of houses. • Variety in urban fabric and typology needs to be ensured. • Continued rejuvenation of urban development is important to maintain quality of city life. • Community engagement is required to better understand social needs and manage expectations. 	<ul style="list-style-type: none"> • Business districts are too concentrated within the central core. • Zoning laws, although tending towards more mixed use, currently have resulted in the need to commute more. • Need for greater flexibility in work schemes to better utilise infrastructure on a 24-hour basis. • Better resource use, such as recycling of water at local levels, needs to be addressed. 	<ul style="list-style-type: none"> • High density restricts industrial developments. • Attractiveness of the city in retaining talent may be compromised by congestion, less accessibility to amenities, and the like. • Social cohesiveness is needed within diversity. • Inequality is increasing in terms of income gaps. • Challenges exist in bringing mixed-use environments together in integrated developments without congestion and crowding.

Workshop II

Agenda

The main purpose of the second workshop was to corroborate, consolidate, and further develop the 24 principles gleaned from the first workshop. To enrich the inputs from participants, some discussion questions were circulated before the workshop date. The discussion questions were meant to help participants deliberate on the proposed principles based on their own experiences and expertise. Participants discussed these principles with examples and identified possible challenges and probable action agents. Participants were also encouraged to come up with new principles that may be relevant to the urban landscape of the future, especially in the context of urban trends such as globalisation, new technologies, and new demographic profiles.

Outcome

Participants discussed the 24 principles in more detail, using examples from Singapore's development experience. For each of the 24 principles, participants considered the likely implementation challenges and conditions necessary for these principles. The findings are presented in the table.

The workshop then condensed the 24 principles into ten and proposed that the findings of the study be made into a report.



Second workshop discussions.

Principle	Examples	Challenges	Actions that can support the principle
1. Pay upfront for green technologies.	<ul style="list-style-type: none"> • Tree Lodge at Punggol (residential development) goes beyond passive design interventions and uses green technologies. • LED lighting in common corridors of HDB flats, implemented in new and older estates (2,500 blocks), are more energy efficient in the long run. • Changi Airport: using solar energy, dimming lights, installing motion sensors, shutting down escalators at non-peak hours, using recycled water, using LED lights in Terminal 1. 	<ul style="list-style-type: none"> • How can green technologies be defined so they also include passive design interventions? • How can green technological considerations be made a fundamental and integral aspect of all urban developments? • How can the concerns about the high costs of green technology be addressed to result in its widespread application? • How can a societal shift in attitudes towards green technologies be brought about so they do not remain merely a marketing tool used for promotion of new technology? 	<ul style="list-style-type: none"> • Plan ahead and integrate green technologies and designs for future developments. • Provide encouragement from the government in the form of incentives. • Explore public/private partnership models that may enable wider use of green technologies.
2. Bring people to water.	<ul style="list-style-type: none"> • East Coast Park, which is by the sea, is a good example of a waterfront development. • Ulu Pandan canal is used for recreational activities. • Bishan Park is a good example of multiple-use public space. • The Boardwalk at the MacRitchie Reservoir. 	<ul style="list-style-type: none"> • Buy-in from people for various recreational projects is difficult to secure. • How can recreational spaces, especially close to water, be designed that are safe for use at all time 	<ul style="list-style-type: none"> • Engage the community to get buy-in for successful development and use of new recreational spaces near water bodies.
3. Cloak space in green where the eye can see it.	<ul style="list-style-type: none"> • Green wall design in Pasir Ris complex. • Green lung planning for HDB. • Design features of surface car parks at HDB housing estates that encourage growth of green patches. • Community in Bloom project. 	<ul style="list-style-type: none"> • How to introduce green spaces in existing developments? • How to incentivise new developments to include green features? 	<ul style="list-style-type: none"> • Have a mechanism for regular and sound maintenance and management of the greenery.
4. Use low-energy options.	<ul style="list-style-type: none"> • Green vehicles 	<ul style="list-style-type: none"> • People are unwilling to pay for green technologies. • Benefits are difficult to quantify. 	<ul style="list-style-type: none"> • Price green technologies for wider use. • Provide government incentives and support. • Seek cooperation and support of the private sector and civil society. • Create education programmes.

Principle	Examples	Challenges	Actions that can support the principle
5. Make parks integrated with lifestyle and leisure.	<ul style="list-style-type: none"> • East Coast Park. • Pasir Ris Park. • Southern Ridges. • Botanic Gardens. • Bishan Park. • Day and night activities at parks, void decks, sky gardens in the HDB blocks. 	<ul style="list-style-type: none"> • How can landscaped gardens be made more accessible to people? • Tropical weather of Singapore may constrain outdoor activities. 	<ul style="list-style-type: none"> • Increase features such as shaded shelters and the like to attract more people to these spaces. • Make regular improvements to the quality of parks and lifestyle amenities. • Retain and reintroduce organic features in parks.
6. Plan for long-term growth and renewal.	<ul style="list-style-type: none"> • Marina Bay was developed through the provision of "white sites" in the Master Plan. 	<ul style="list-style-type: none"> • Volatility in economy and population and demographic changes create difficulty in tying long-term growth plans to short- and medium-term objectives. 	<ul style="list-style-type: none"> • Have provisions in the plan documents for future growth and development.
7. Plan for change and renewal.	<ul style="list-style-type: none"> • Clarke Quay. Infrastructural improvements, such as covered walkways, cooling systems, and the like, have helped attract people at all times of the day and at night. • Jurong Lake district has integrated retail, commercial, and office space, which incentivises private developers to finance infrastructure development. 	<ul style="list-style-type: none"> • How can the existing regulations and bylaws be made more responsive to redevelopment requirements? • Can the lease tenures be made more flexible to improve the financial viability of redevelopment projects? • How can a balance be struck between the private and public sectors to deliver sustainable outcomes? 	<ul style="list-style-type: none"> • Encourage urban development agencies in their willingness to look anew at and revise land redevelopment plans and regulations. • Incentivise public/private partnerships to make redevelopment projects financially viable and more prevalent.
8. Encourage diversity in the city.	<ul style="list-style-type: none"> • Promotion of diversity in cuisine and cultures . • Diversity in religions and the abundance of religious places. • HDB's Ethnic Integration Policy. • Transformation of unused schools into venues for artists and entrepreneurs. • University alumni associations. 	<ul style="list-style-type: none"> • Does the emergence of a free market economy dilute diversity in cities? • Urban planning and development adversely affects the organic diversity of places within a city. 	<ul style="list-style-type: none"> • Government and civil society give support towards retaining or encouraging diversity in the city. • Encourage inorganic diversity.
9. Build a culture of innovation.	<ul style="list-style-type: none"> • Biopolis: a research and development centre for biomedical sciences. 	<ul style="list-style-type: none"> • Risk and high cost of failure. • Changing people's mind-set. • Small market size. 	<ul style="list-style-type: none"> • Have a highly educated and talented workforce. • Have financial resources for research and development investments. • Create supportive infrastructure facilities. • Encourage interagency collaboration.
10. Build compact mixed-use neighbourhoods that are easy to get around.	<ul style="list-style-type: none"> • New towns such as Tampines and Toa Payoh. 	<ul style="list-style-type: none"> • Managing interagency coordination. 	<ul style="list-style-type: none"> • Have planning guidelines and standards.

Principle	Examples	Challenges	Actions that can support the principle
11. Let public spaces bloom (even on rooftops).	<ul style="list-style-type: none"> • Vivocity (mall) rooftop: good example of public space and well-designed vistas. • East Coast and Bishan Parks. • Conversion of spaces under flyovers such as at Thompson into futsal soccer courts. • Park connectors. 	<ul style="list-style-type: none"> • Private to semiprivate nature of rooftop gardens makes them inaccessible as public spaces. • Striking a balance between land required for commercial needs and for community needs is difficult, for example, public spaces being converted into car parks, or void decks in HDB flats being converted into elderly and child care centres. • Density pressures result in reduction of public spaces. 	<ul style="list-style-type: none"> • Allow multiple use of space. • Promote the safeguarding of big open public spaces.
12. Grow communities of interest.	<ul style="list-style-type: none"> • Rail Corridor project promotes community interaction and creates new public spaces. • Community in Bloom programme is an example. 	<ul style="list-style-type: none"> • Difficulty in finding people with shared common interests. 	<ul style="list-style-type: none"> • Gather a critical mass of support for each particular interest. • Establish good interagency coordination systems.
13. Create self-sufficient neighbourhoods with affordable homes.	<ul style="list-style-type: none"> • New towns such as Toa Payoh and Tampines have full facilities for recreation and jobs. 	<ul style="list-style-type: none"> • Interagency coordination. 	<ul style="list-style-type: none"> • Have a robust and responsive housing policy. • Encourage and emphasise homeownership. • Ensure good quality and easy-to-use public transport systems.
14. Build social inclusion where possible.	<ul style="list-style-type: none"> • HDB housing policy. 	<ul style="list-style-type: none"> • Balancing socio-economic equity. • Difficulty in preventing the formation of community enclaves in private housing. 	<ul style="list-style-type: none"> • Provide common amenities that connect people.
15. Make space work hard in more ways than one.	<ul style="list-style-type: none"> • Co-location of sports facilities with community facilities. • Mixed-use developments, for example, MRT stations with commercial uses. • Futsal courts under flyovers. • Car parks for go-karting, skate parks . • Art galleries at shipyards. 	<ul style="list-style-type: none"> • Land policies and regulations may put a constraint on multiple uses of spaces. 	<ul style="list-style-type: none"> • Ensure interagency cooperation and coordination.
16. Insert spaces of relief and keep places distinct.	<ul style="list-style-type: none"> • Bishan Park. 	<ul style="list-style-type: none"> • Lack of land availability. 	<ul style="list-style-type: none"> • Ensure interagency cooperation and coordination.

Principle	Examples	Challenges	Actions that can support the principle
17. Use interim spaces as flexible events spaces for crowds.	<ul style="list-style-type: none"> Temporary occupation licenses are often issued for alternative use of soccer fields and basket ball courts. During festive seasons informal bazaars or other recreational activities are introduced at these spaces. 	<ul style="list-style-type: none"> Popular attachment to the temporary spaces is an obstacle to long-term redevelopment plans for these spaces. 	<ul style="list-style-type: none"> Identify alternative spaces to which the creative activities may be shifted in the event of redevelopment.
18. Connect public and private spaces, without walls.	<ul style="list-style-type: none"> ION Orchard (mall). 	<ul style="list-style-type: none"> Prevalence of gated communities that restrict access to spaces. 	<ul style="list-style-type: none"> Encourage good design. Have appropriate zoning.
19. Use checkerboard planning for variety.	<ul style="list-style-type: none"> The layout of the new towns. 	<ul style="list-style-type: none"> As density grows, it would be a challenge to develop towns in a checkerboard manner. 	<ul style="list-style-type: none"> Have differentiating features for the various town centres to give each a more distinct character.
20. Create underground spaces plugged into transport nodes.	<ul style="list-style-type: none"> Citylink mall. 	<ul style="list-style-type: none"> Non-alignment of land use and transport plans. Underused public transport nodes. 	<ul style="list-style-type: none"> Ensure interagency coordination. Generate private sector interest to develop the underground spaces.
21. Design and activate safe spaces.	<ul style="list-style-type: none"> HDB designs and layouts. 	<ul style="list-style-type: none"> Prevalent urban design features do not focus adequately on streets. 	<ul style="list-style-type: none"> Encourage designs that promote safety.
22. Live/work/learn/play smart.	<ul style="list-style-type: none"> Robertson Quay. Marina Bay. Tampines New Town. 	<ul style="list-style-type: none"> Spontaneity is discouraged in Singapore. 	<ul style="list-style-type: none"> Plan for supportive infrastructure. Use urban design controls that help stitch together urban developments to allow a live/work/learn/play environment.
23. Involve community and stakeholders.	<ul style="list-style-type: none"> URA's Master Plan consultation process. SERS and upgrading exercises. Feedback collection by HDB. 	<ul style="list-style-type: none"> Lack of ground-up initiatives. 	<ul style="list-style-type: none"> Establish a clear structure and process for public consultation and engagement. Have a balanced and guided consultation process driven by clear objectives. Adopt a fluid system of engagement that adapts to social conditions and ensures relevance. Establish a well- developed feedback system.
24. Work collaboratively among agencies and with markets.	<ul style="list-style-type: none"> Somerset 313 and ION Orchard malls connect public transport systems with commercial centres. One-north business park which has been developed on a public private partnership model. 	<ul style="list-style-type: none"> People, public, and private sector (3P) partnerships have not had much success in Singapore. 	<ul style="list-style-type: none"> Encourage a deeper understanding and wider acceptance of 3P models among government officials.

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AECOM – pp.29(b), 29(c), 39 (right), 51
Housing Development Board – pp. 34, 44, 61 (right)
Nina Cecilia Ballesteros – pp. 36 (Background)
PUB – pp. 36 (Insert), 42, 46-47, 48
avocadolite.com – pp. 39 (left)
Chu Wa, Franciso – pp. 45(c)
Keppel Corporation – pp. 45 (Keppel Merlimau Cogen Plant)
Atelier Dreiseitl – pp. 48
Relan Masato – pp. 52-53
STB – pp. 55
JTC Corporation – pp. 60
Far East Organization – pp. 61 (left)
SengkangBabies – pp. 64