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RAIL+PROPERTY DEVELOPMENT

A MODEL OF SUSTAINABLE TRANSIT FINANCE AND URBANISM

ROBERT CERVERO AND JIN MURAKAMI

Rail + Property Development

A Model of Sustainable Transit Finance and Urbanism

Robert Cervero and Jin Murakami

Authors

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Table of Contents

Part I
″Rail + Property″ Development in Hong Kong

Hong Kong's principal rail operator, the MTR Corporation (MTRC), has advanced the practice of transit value capture more than any public-transport organization worldwide. It has done so through its "Rail + Property" development approach, or R+P. Chapter One examines the evolution and implementation of R+P since its inception in the mid-1980s. The role of MTRC as master planner of station-area development and the process introduced to share risks and rewards among public and private stakeholders are discussed. Chapter Two discussed R+P as a form of transit-oriented development (TOD). Through good quality urban design and attention to the needs of pedestrians, concentrating growth around stations can not only help finance capital infrastructure but can also contribute to place-making and community enhancement.

Chapter One

MTR Corporation's "Rail + Property" Development Approach

1.1 Introduction

Hong Kong is internationally known for its successful integration of rail transit investments and urban development. The city's exceptionally high densities, and the many agglomeration benefits that have resulted, could not have been achieved without world-class railway services. Hong Kong is also one of the few places in the world where public transport makes a profit. This is due in large part to the integrated "rail-property" development model, or R+P for short. Implemented by the MTR Corporation (MTRC), the owner-operator of the city's largest rail service, the R+P model is one of the best examples anywhere of applying the "value capture" principle to finance railway investments.[1] Given the high premium placed on access to fast, efficient and reliable public-transport services in a dense, congested city like Hong Kong, the price of land near railway stations is generally higher than elsewhere, sometimes by several orders of magnitude. The owner-operator of the transit system can recoup the cost of investing in rail transit and even turn a profit from property development, as has been the case in Hong Kong. R+P has been MTRC chief instrument for doing this.

This report examines the R+P "approach" to railway finance and its larger role in building station-area communities and shaping regional growth. As discussed later, the word "approach" is used because R+P is more than an end-product of "brick and mortar" atop subway stations; rather, it is a carefully conceived process for planning, supervising, implementing, and managing station-area development and tapping into the land-price appreciation that results. And R+P's reach extends beyond the walking catchments of stations. Its role in shaping the city and surroundings has gained importance as Hong Kong continues to transform from a pre-industrial colonial settlement to a dynamic global urban center. With the re-structuring of Hong Kong's economy toward a service- and information-based economy, railway investments have gained all the more importance in spatially channeling urban growth and recycling former industrial land.

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[1] The other major railway service available in Hong Kong is the Kowloon-Canton Railway (KCR).

The report is organized as follows. First, the R+P approach and its evolution are discussed, as a means of financing capital infrastructure, creating viable neighborhoods around stations, and shaping urban growth. Next, a case is made that R+P represents an important form of Transit Oriented Development (TOD) as well as Transit Joint Development (TJD). Connected to this is R+P as a tool for "place-making". Chapter Three is devoted to building and presenting several typologies of R+P projects. Notably, R+P projects are distinguished in terms of their built environments, housing types, and ridership patterns. Also, the "5 Ds" (density, diversity, design, distance to transit, and destination accessibility) are introduced as a basis for classifying R+P projects based on built environments.

In carrying out the work, it became evident that what was missing from the quantitative assessment and classification of R+P projects was insights into the quality of the urban environment, both on-site and near-site – notably, factors like ease of walking, aesthetics, and the presence of public amenities. Case studies were carried out to fill this void, focusing on urban design qualities and walkability measures for R+P, non-R+P railway stations, and even areas without MTR services. In addition to these design discussions, Chapter Four addresses the public-private partnership arrangements behind the case-study R+P projects for different phases of development. Since newer generation R+P projects differ considerably from earlier ones, particularly with regard to urban design, Chapter Five supplements the case work by examining experiences with R+P and ridership patterns along three different corridors that correspond to different phases of MTR expansion: the original urban lines, the more recent Tung Chung line that extends to Hong Kong's new international airport, and the most recent Tseung Kwan O extension (focused on redeveloping industrial zones with residentially-based new towns).

The sixth Chapter of the report is devoted to assessment – specifically, the influences of R+P as well as TOD designs on MTR ridership and real-estate prices. The ridership analysis focuses on the degree to which R+P projects produce a ridership bonus at stations and whether projects built according to TOD principles enjoy even a larger bonus effect. Modeling the many factors that affect housing prices in a complex and dynamic real-estate market like Hong Kong's is a challenging task. Follow-up work should be carried out as MTRC's portfolio of R+P projects expand and a richer time series is available for studying performance impacts.

Chapter Seven looks at the role of R+P in promoting larger land-use and transportation objectives for the Hong Kong metropolitan area. The contributions of R+P in advancing such expressed planning objectives as jobs-housing balance, stimulating redevelopment of former industrial zones, and increased pedestrian travel are addressed.

Lastly, the report examines experiences with public-transport finance and transport/land-use integration in two other large, rail-served Asian metropolises: Tokyo and Singapore. Both city-regions boast highly successful railway services that are financially solvent, though for different reasons. Both also feature TOD built-forms, though the roles of public-transport operators in land development differ markedly from Hong Kong's experiences. The report ends with discussions on key lessons and the potential transferability of lessons drawn from all three Asian settings – Hong Kong, Tokyo, and Singapore – to fast-growing cities of mainland China which currently have or are contemplating large-scale rail transit systems.

This is not the first in-depth study of MTRC's R+P programme. The Hong Kong Polytechnic University produced an informative report on the R+P model in late-2004, focusing on the programme's institutional context.[2] Our study aims to build upon this work through classifying R+P projects, probing more deeply the connections between R+P and ridership as well as regional planning objectives, and comparing Hong Kong's experiences with peer Asian cities in hopes of constructively informing policy-making in rapidly growing cities of China and other parts of the industrializing world

1.2 Railway Services in Hong Kong

Hong Kong has a highly developed and sophisticated public transport network, which includes two high-capacity railways, trams, buses, minibuses, and ferries. Over 90% of all motorized trips in Hong Kong are by public transport, the highest market share in the world (Lam, 2003). MTRC itself operates solely passenger rail services. The MTR railway alignment runs through the densest parts of the territory – mainly the flatter coastal areas, including the extremely dense northern shoreline of Hong Kong island and the Kowloon peninsula. Figure 1.1. shows MTRC's network as of mid-2007.

[2] BS Tang, YH Chiang, AN Baldwin and CW Yeung, *Study of the Integrated Rail-Property Development Model in Hong Kong*, The Hong Kong Polytechnic University, 2004.

Figure 1.1. MTRC Railway Network, mid-2007

Historically, MTRC was one of two rail operators that served Hong Kong, the other being the Kowloon-Canton Railway Corporation (KCRC). In December 2007, the two companies merged under the name of MTRC. This merger combined MTRC's 91-km, six rail-line service with the former KCRC 35-km network (that linked areas of the Northern Territories un-served by MTR with lower Kowloon). Since this report focuses on MTRC's experiences with R+P programme as of mid-2007, all statistics presented are prior to merger. With 53 stations, in mid-2007 the MTR network averaged a station every 1.6 kms, making up of the finest-grained railway networks anywhere – not unexpectedly given it serves the world's densest city (exceeding 55,000 inhabitants per square-km in parts of Kowloon).[3] In 2006, MTR served 25.2 percent of all public-transport trips made within the Hong Kong territory, including those by bus, minibus, ferries, and trams, a market share that has steadily increased in recent years.

The combination of high urban densities and high-quality public transport services has not only produced the highest level of transit usage in the world (570 annual public transport trips per capita), but has also substantially driven down the cost of motorized travel. In 2002, over half of all motorized trips made by Hong Kong residents were a half hour or less (ARUP, 2003). Figure 1.2 shows that motorized travel consumes, on average, around 5 percent of Hong Kong's Gross Domestic Product (GDP). This contrasts sharply with more automobile-oriented cities like Houston and Melbourne, where upwards of one-seventh of

[3] http://www.aviewoncities.com/hongkong/hongkongfacts.htm

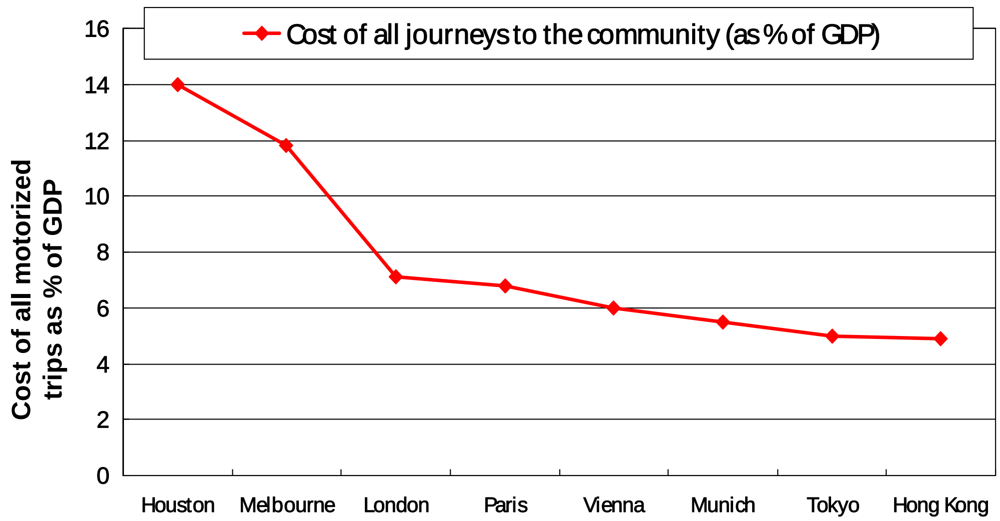

Figure 1.2. Comparison of Cost of Motorized Travel as a Percent of Gross Domestic Product (GDP) Among Global Cities. *Source*: UITP/ISTP Millennium Cities Database for Sustainable Transport

GDP goes to transportation. Hong Kong residents enjoy travel cost savings even in comparison to much larger global cities with extensive railway networks, like London and Paris.

1.3 MTRC and Property Development

MTRC's central mission is to construct, operate, and maintain a modern, safe, reliable, and efficient mass-transit railway system.[4] Serving a quarter of all public transport trips within Hong Kong and connecting the region's largest activity centers including the new international airport, MTR plays an integral and increasingly important mobility role in the special territory of Hong Kong. The railway has also played a vital city-shaping role. In 2002, around 2.8 million people, or 41% of Hong Kong's population, lived within 500m of an MTR station (Tang et al., 2004). One in five households lived within 200m of a station.

[4] MTRC, *2005 Annual Report*

Clearly, MTR stations have been magnets in attracting growth.

<u>MTRC and R+P</u>

MTRC makes it clear in its *Annual Reports* and other corporate documents that it operates on commercial principles, financing and operating railway services that are not only self-supporting but also that yield a net return on investment. Property development has been the chief tool for generating revenues that cover the costs of constructing railway improvements and provide net profits. MTRC's philosophy is that a railway alone cannot provide adequate commercial return and only through property development can the company attract private investors and remain financially solvent. Effectively, the fully-loaded costs of public-transport investments, operations, and maintenance are covered by supplementing fares and other revenues with income from ancillary real estate development – what economists call value capture.[5] Since land parcels near railway stations in dense, traffic-choked cities like Hong Kong are highly valued, the transit agency captures these benefits through land leases and sales to private interests. As revealed in the *Mission Statement* of MTRC's Property Division, value-capture is only part of the goal; creating high-quality, viable communities and enhancing station-area environments is also important (Figure 1.3).

Throughout the 1980s and 1990s, the Hong Kong Special Administrative Region (HKSAR) government was the sole owner of MTRC. In the Fall of 2000, about 23% of its shares were offered to private investors on the stock exchange. The presence of private shareholders exerted a strong market discipline on MTRC, prompting the company managers to become more entrepreneurial and business-minded. The ratcheting up of the R+P programme in recent years reflects MTRC's strong market orientation. However, HKSAR's majority shareholder status ensures MTRC weighs the broader public interest in its day-to-day decisions. Consequently, R+P is not only a financial model but also a tool for serving broader town-planning objectives, like promoting TOD. Today, Hong Kong MTR is one of the most successful build-operate-maintain transportation systems anywhere, courtesy of R+P.

R+P, and value capture more generally, is hardly a new concept. It was successfully applied in the United States well over a century ago to finance urban

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[5] Besides designing, building, construction and operating mass-transit railway services and property development, MTRC is also engaged in property investment and management. These activities are discussed later in the report.

streetcar networks (Bernick and Cervero, 1997). By 1912, private landholders built inter-urban rail lines as a loss-leader in over two dozen U.S. cities, opening up land for property development that yielded tremendous profits, easily covering investment and operating costs. In today's automobile era, no other global city has resurrected the practice of public-transport value capture to the degree that Hong Kong has.

Figure 1. 3. Mission of MTRC's Property Division

Benefits of Integrated R+P Development

MTRC's active involvement in property development is what distinguishes it from other public transport organizations worldwide.[6] Property development

[6] In a study conducted by the Legislative Council of Hong Kong (Liu et al., 1996) on mass transit systems in six global cities (Osaka, Seoul, Toronto, London, Singapore and Hong Kong), only Hong Kong and Singapore were found to be "operating on commercial principles". Construction costs in Singapore, however, were borne by the government while in Hong Kong the mass transit entity fully bears the costs. In an international survey conducted by Barron et al. (2001), Hong Kong was the "lone exception" in relying on government grants and transfer payments to cover the majority of capital costs. Hong Kong's only form of support is the injection of equity capital; the returns from higher equity shares cover these costs.

plays two important financial roles. The chief one is to finance infrastructure. Notably, R+P relieves the public sector of the financial burden of floating bonds and incurring debt to finance railway expansion. Additionally, it creates a ready-made market of transit users – in the form of residents living near stations, employees working around stations, and shoppers passing through stations – who generate farebox revenues. These are just the direct financial benefits. Indirectly, property development confers such "second-order" benefits as:

- Improved station-area environments – in the form of master planning that improves circulation, physical integration of stations with surrounding retail-shopping facilities, and enrichment of land uses, all of which can further boost land values and increase ridership;
- Integration of retail-shopping into station environments, generating ancillary income from retail sales as well as prompting some transit riders who pass by to purchase goods; and
- Through public control of land near stations, moderating land speculation and preventing the land-value benefits afforded by rail improvements from accruing to a handful of private individuals.

1.4 R+P: How it Works

MTRC does not receive any cash subsidies from the Hong Kong government to build railway infrastructure; instead it receives an in-kind contribution in the form of a land grant that gives the company exclusive development rights for land above and adjacent to its stations. These grants relieve MTRC from purchasing land on the open market. To generate income, MTRC capitalizes on the real-estate development potential of its stations. Ho (2001) describes property development as the 'jewel in the MTRC's crown".

The specific mechanism for capturing rail's value-added is as follows. MTRC purchases development rights from the Hong Kong government at a "before rail" price and sells these rights to a selected developer (among a list of qualified bidders) at an "after rail" price.[7] The differences are often substantial and are

[7] The Hong Kong Special Administrative Region owns all land in the Hong Kong territory. Private individuals and organizations can only purchase 50-year leases that grants exclusive property development rights.

able to cover the cost of railway investments.[8]

The Hong Kong government, the majority shareholder of MTRC, seeds the process by granting MTRC exclusive development rights based on the "greenfield" site value (i.e., pre-rail price). MTRC also negotiates a share of future property-development profits and/or a co-ownership position from the highest bidder. Thus MTRC receives a "front end" payment for land and a "back end" share of revenues and assets in-kind.[9]

Table 1.1 summarizes MTRC's portfolio of R+P projects in 2006 and Figure 1.4 maps their locations. By design, MTRC has pursued a diverse portfolio of projects to shield the company from swings in Hong Kong's business cycle. In addition to R+P, MTRC has diversified its holdings through equity ownership, cash holdings, property management, consulting, advertising, and ownership of other assets (e.g., telecommunication leases, convenience retail shops). Thus, if Hong Kong's real-estate market softens, MTRC is buffered through other asset holdings; if the land market strengthens, the company participates in this upside through both R+P leases and equity ownership.

R+P's vital income-producing role is revealed by Figure 1.5. Over the 2001-2005 period, property development produced over half of MTRC's revenues. By contrast, railway income, made up mainly of farebox receipts, generated 28 percent of total income. Together, MTRC's involvement in property-related activities – i.e., development, investment, and management – produced 62 percent of total income, more than twice as much as user fares.

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[8] MTRC aims to set returns for its investments based on the WACC – the weighted average cost of capital – presently set at 9.5% (reflecting the expected return in equity and interest from borrowing) plus a rent premium of between 1.5% and 3% for equity shareholders, yielding a 11% to 12.5% return. The WACC fluctuates based loan rates charged by commercial banks. For riskier projects, the WACC might be set at 10% plus a 3% premium, yielding a 13% net return. MTRC will invest in railway projects if these net rates of return (11% to 13%, depending on risks) are attained. This "WACC+premium" formula is used to guide not only railway investment but also MTRC's own real-estate investment, including shopping malls attached to stations.

[9] If the private leaseholder suffers future revenue losses, contractual arrangements protect MTRC from participating in the losses.

Table 1.1. MTRC's Property Development Overview, 2006

	Type of Land use					
	Residential	Commercial	Office	Hotel/ Service Apartments	Government & Institutions	No. of Carparks
	(# Units)	*GFA (m²)*	*GFA (m²)*	*GFA (m²)*	*GFA (m²)*	*($ Spaces)*
Urban Lines	31,682	314,923	208,866	0	143,034	6,012
Airport Line	28,650	306,640	611,963	291,722	24,770	14,360
Tweung Kwan O Line	29,167	105,814	5,000	58,130	*	6,547
Total	89,499	727,377	825,829	349,852	167,804	26,919

* Community facilities including schools as well as elder and youth centres will be provided however the amount of floorspace is subject to government agreements.

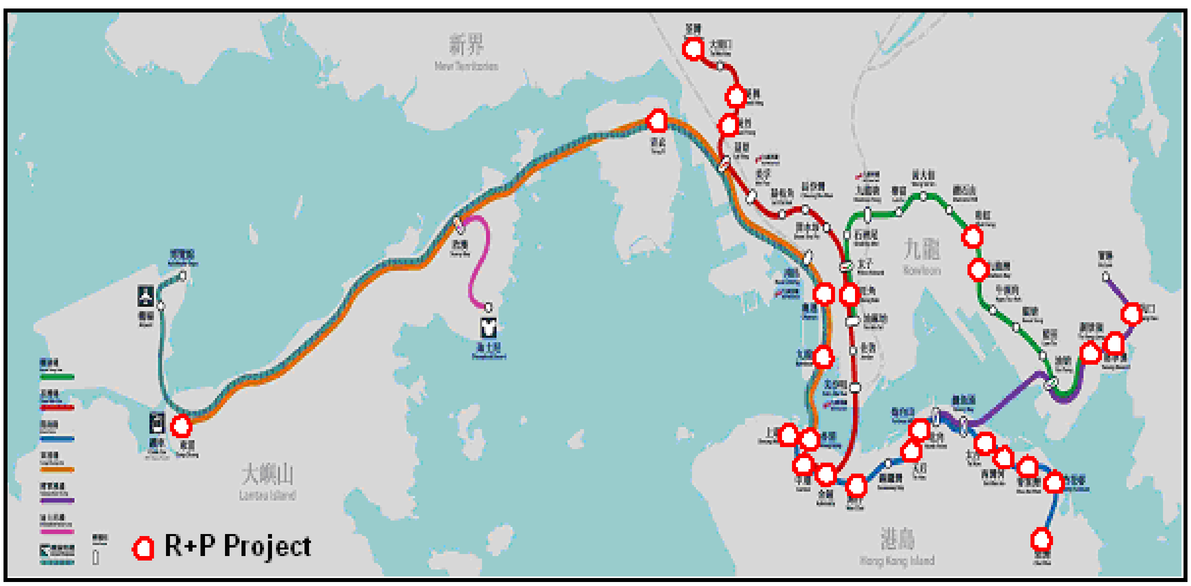

Figure 1.4. Location of Hong Kong's R+P Projects, 2007

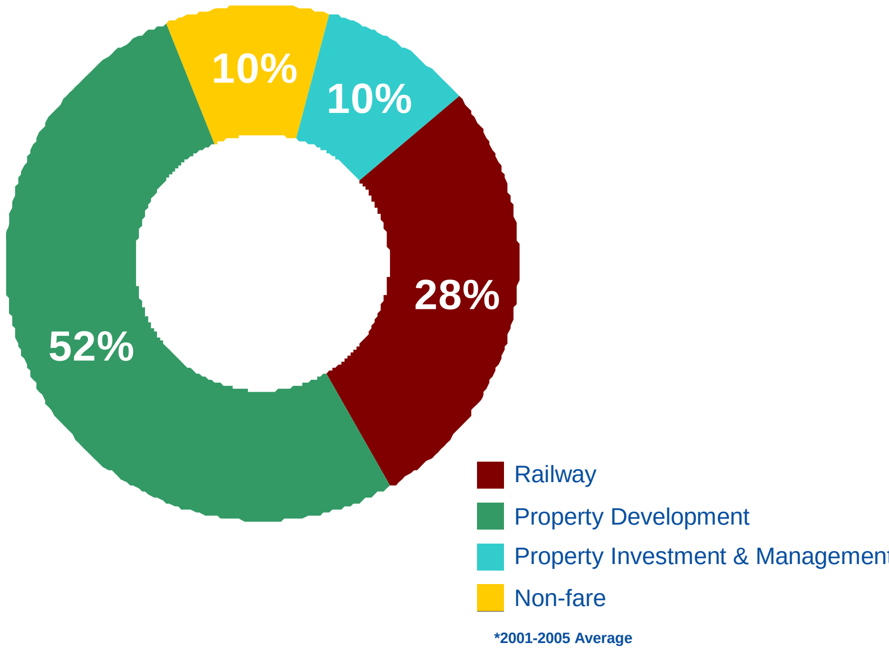

Figure 1.5. MTRC Revenue Sources, 2001-2005 Average.
Source: MTRC financial accounts.

Timing and project phasing are critical to the success of R+P given the cyclical nature of Hong Kong's real-estate market. In recent years, MTRC has relied on property development to generate profits to pay off past debt. This is reflected by Figure 1.6, which charts annual profits/losses from property development and other recurring businesses over the 1980-2005 period. During the 1980s, MTRC mostly incurred net losses (based on differences between revenues and combined operating and depreciated capital cost as well as debt service). Even during this period of operating in the red, property development moderated losses. Beginning in the late 1990s when MTRC began aggressively pursuing R+P along the Airport Railway Line, the net yields provided crucial income that went to finance the more recent Tseung Kwan O extension. It took approximately 10 years (1997 to 2007) to fully pay off capital debt for the Airport Line extension. From 2007 onward, earnings from R+P projects on the Airport Line produce funds that no longer need to go toward paying off this debt, allowing these funds to be used to cover costs of Tseung Kwan O and other planned extensions.

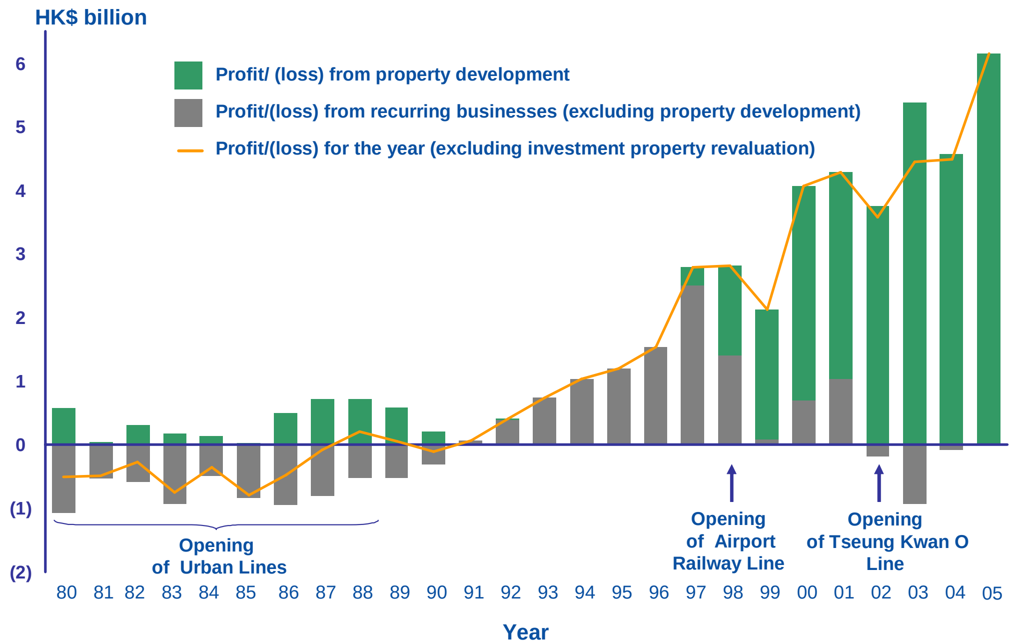

Figure 1.6. Trends in MTRC's Profits and Losses from Property Development and Recurring Businesses for the 1980 to 2005 Period

MTRC has hardly been the sole financial beneficiary of R+P. Society at large, reflected by Hong Kong SAR's majority ownership of MTRC, has also reaped substantial rewards. For the 1980 to 2005 period, it is estimated that Hong Kong SAR has received nearly $140 billion (in today's Hong Kong dollars) in net financial returns. This is based on the difference between earned income ($171.8 billion from land premiums, market capitalization, shareholder cash dividends, and initial public offer proceeds) and the value of injected equity capital ($32.2 billion). Thus the government of Hong Kong has enjoyed tremendous finance returns and seeded the construction of a world-class railway network without having to advance any cash to MTRC. The $140 billion figure, of course, is only the direct financial benefit. The indirect benefits – e.g., higher ridership through increased densities, reduced sprawl, air pollution, and energy consumption, etc. – have increased net societal returns well beyond $140 billion.

1.5 The R+P Development Process

What triggers R+P projects are future plans to extend MTR lines or construct new ones, consistent with regional land-use and urban development goals set by Hong Kong government. MTRC staff works closely with government planners and transportation professionals to define and assess the comparative costs of different alignment and station-siting options. They also discuss property development opportunities that enhance financial returns of the railway investment and promote long-range planning objectives. Within the organization, MTRC managers weigh factors like the value of land, density potential, and project size and scale in deciding whether to advance a specific R+P proposal.[10] The setting of minimum density and size thresholds means R+P projects have in the past mostly responded to versus leading the way in stimulating new development, although recent developments like Tung Chung station on the Airport Line and Hang Hau new town at the terminus of the recent Tseung Kwan O line are examples of R+P preceding urban development.[11]

The assembly of land uses to be built at the station is largely determined by market demand, constrained by zoning regulations. Commercial property development has occurred mostly at and near central-city MTR stations while residential projects have been built mainly in outlying areas and at terminal stations. Other factors also come into play in defining R+P possibilities and specific land-use configurations, such as the presence of a large depot (providing storage areas for trains). MTRC's first R+P project, Telford Gardens, kicked off mainly because a large podium, slab-cover depot deck was built at the Kowloon Bay Station (Figure 1.7 and Photo 1.1). The resulting expansive surface area presented opportunities to build this pioneering and successful mixed residential-office-commercial project.

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[10] Plot ratios of at least 2.5 are generally viewed as necessary if R+P is to be financially remunerative. Also, land values need to be above some defined threshold to generate enough aggregate income to justify R+P initiatives. And there needs to be a critical mass of land to make pursuing R+P financially worthwhile.

[11] Brownlee (2001) notes that the reliance on value capture for funding investment means there must generally be a population base in place before a railway is built. He writes: "Thus it took years before a rail line could be built to new towns, such as Tseung Kwan O. The rail operator had to effectively wait for population to get up to above 250,000. This way of financing rail has caused delay in building rail to population centers." (Brownlee, 2001, p. 4).

Once the decision is made to move forward with a specific R+P proposal and all parties are in agreement, the government of Hong Kong grants MTRC exclusive development rights for specific sites, defining tower locations, permissible uses, and plot-ratio densities (i.e., floorspace divided by land area). MTRC staff then prepares a master layout of the project, including the siting and massing of buildings, block designs, standards for building quality, and locations of vehicle access points. They also obtain necessary statutory planning approvals for the proposed development.

Next, MTRC issues tenders bids among potential developers and selects a partner based on the attractiveness of competing financial offers, experience, management capabilities, and other factors. Developers are given some flexibility to recommend and negotiate site modifications to R+P proposals. Once a public-private partnership is agreed to, the developer typically pays a "with rail" land premium for exclusive development rights and all development costs. In most instances, MTRC has a profit-sharing agreement, receiving a set percentage of future profits as well equity ownership – as in the case of the International Financial Centre tower above the Hong Kong station, the city's tallest building, wherein MTRC negotiated ownership of 18 floors as an asset in-kind (Photo 1.2).

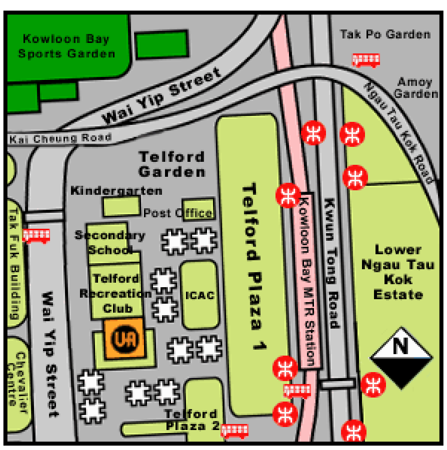
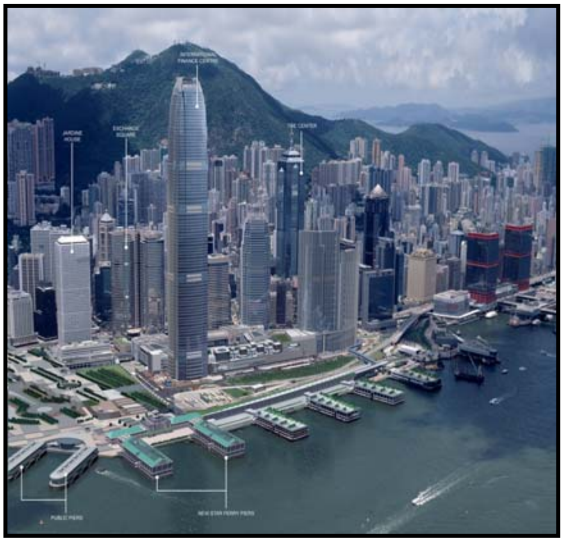


Figure 1.7 and Photo 1.1. Telford Garden and Plaza Mixed-Use Residential-Shopping-Office R+P Project at the Kowloon Bay Station



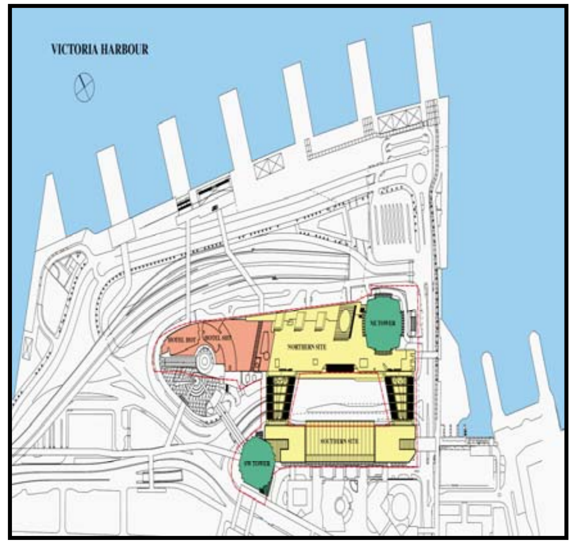


Photo 1.2. International Financial Centre Tower at Hong Kong Station, Hong Kong's Tallest Building. MTRC owns 18 floors of the office tower as an in-kind asset.

Once a project breaks ground, MTRC does not disappear from the scene. To the contrary, the company oversees project design, engineering, and construction, and many times stays involved as the property manager. This continuous, seamless involvement from project conceptualization to implementation to property management ensures that original visions are adhered to, there is continuity to project development, and a reliable, transparent, and well-managed development process unfolds. Also, project tenants have confidence that R+P projects are high-quality places to reside and run a business because the master planner, MTRC, remains actively involved throughout the development process. Indeed, MTRC's "on-site presence" means a responsible company official is readily available to field and respond to concerns and weigh the views of all stakeholders in day-to-day decisions. The rapid absorption of new units and retail space at recently built mixed-use R+P projects like at the Kowloon, Tung Chung, and Tsing Yi stations is a testament to MTRC's commitment not only to project construction but also management and oversight. And the fact that Hong Kong's government continues to grant MTRC exclusive property development rights suggests that the populace at-large is happy with the results.

R+P as an Approach, Not a Product

R+P, it is worth noting, is as much an "approach" as a "product". Yes, shiny new buildings atop subway stations are the tangible outcomes of R+P. However, R+P also plays a vital role in managing and financing railway expansion, advancing high-quality urban designs, creating "one-stop" settings for "live-work-shop-play", guiding regional urban growth, and more. As with all good public-private partnership, this occurs in a win-win fashion – i.e., the railway corporation reaps financial benefits and society at-large benefits from more sustainable, transit-oriented patterns of development.

In their in-depth study of R+P's institutional structure, Tang et al. (2004) identify four key elements behind the R+P approach:

(1) *Policy*. Favorable government support of transit and land-use integration, expressed by land grants and financial assistance to MTRC;
(2) *Process*. Forward-looking planning, management, and control procedures that ensure an efficient approach from project inception to completion;
(3) *Project*. High-quality real estate projects that appeal to tenants, shoppers, and transit users; and
(4) *Organization*. An entrepreneurial entity that balances the financial interests of investors with larger societal goals.

<u>MTRC as Master Planner</u>

Tang et al. (2004) also argue that a single entity like MTRC is best suited to manage the complexity of land development and to leverage the opportunities to recapture value created by rail investments. They attribute this to: asset specificity (allowing a professional focus on the intricacies of land development), accumulated knowledge (among MTRC managers), reduced uncertainty (owing to a disciplined approach to property development and accountability to equity shareholders), internalization of transit's value-added (by maximizing ancillary development potential), and asset protection (through involvement in construction and property management).

As the master planner, master designer, and master architect, MTRC aligns the interests of different stake-holders. Importantly, it sets and enforces all development standards. For private developers, the "rules of the game" are clear at the outset. This reduces uncertainties and risks. One-entity oversight also allows strong transit/land-use linkages. In addition, MTRC acts as an intermediary between government and private developers—specifying site requirements, negotiating agreements, and balancing between competing public and private interests.

Today, MTRC has a reputation for undertaking development of high-end residential and up-market commercial projects. This is not only due to the accessibility advantages of properties near railway stations. It is also a product of high-quality station-area designs, MTRC's proficiency at managing and maintaining real-estate projects, and the company's commitment to seamlessly integrating railway stations with surrounding activities.

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Chapter Two

R+P as Transit-Oriented Development

2.1 Transit-Oriented Development and Sustainable Urbanism

While R+P projects are often viewed as an effective tool for financing railway investments, it is important to recognize that it is also a bona fide form of Transit-Oriented Development (TOD). TOD is today widely considered to be one of most sustainable forms of urban development, being practiced in many parts of the world as a means of reducing the dominance of private automobile travel and promoting settlement patterns that are conducive to transit riding (Calthrope, 1993; Cervero et al, 2004, Dunphy et al., 2004). As compact, mixed-use, pedestrian-friendly development centered around transit stations, TOD encourages, by design, "residents, workers, and shoppers to drive their cars less and ride mass transit more" (Bernick and Cervero, 1997, p. 5). Research shows that these features of the built environment – density, diversity of land uses, and walking-oriented designs – substantially influence travel behavior and often prompt travelers to opt for alternatives to the private car, including public transit usage (Kenworthy and Lave, 1999; Ewing and Cervero, 2001). From a user's perspective, TOD allows for a more seamless form of mass-transport travel by bringing the community closer to the transit node itself.

TOD has multiple aims however increasing choices – opening up more options in how to travel, where to live and work, places to go, opportunities to interact with others – is one of its signature feature. So is a variety of land uses and building types. And so is pedestrian friendliness. However, the challenges of creating TOD are more than physical in nature (Cervero, et al., 2002). Attention must also be given to such matters as a station area's security, economic and community development potential, cultural history, and prospects for building social and human capital.

TOD is one form of contemporary movements in urban design -- like "traditional neighborhood design" (TND) or "New Urbanism" -- that aim to stimulate street life and diversify urban landscapes. It is distinguished from other forms of smart growth, of course, by the presence of a railway station. A core idea of these popular design movements is that communities should be like those of yesteryear, in the pre-automobile era, when reliance on foot travel created more compact, small-lot, mixed-use development patterns. Among the trademarks of traditional neighborhoods are a commercial core within walking distance of most residents, a well-connected grid street network, mixed land uses, traffic-calmed local streets, and varying styles and densities of housing.

2.2 TOD in a Regional Context

Successful TODs are not just isolated nodes. One of the major shortcomings of many TODs in the world's most automobile-dependent society, the United States, is that they are simply "islands in a sea of auto-oriented development" (Cervero et al., 2004). A standalone TOD and the absence of other mixed-use nodes to which to travel will do little to prompt travelers to give up their cars and patronize public transport. One of the key lessons from Scandinavian cities like Copenhagen, Denmark and Stockholm, Sweden is the importance of building a network of centers and sub-centers interconnected by high-quality transit (Cervero, 1998). Over fifty years ago, urban planners in both cities articulated cogent visions of future urban form, notably "necklace of pearls" settlement patterns (Figure 2.1). In both cities, corridors for channeling overspill growth from the urban centers were defined early in the planning process, and rail infrastructure was built, often in advance of demand, to steer growth along desired growth axes. In the case of Stockholm, planners strived to create jobs-housing balance along rail-served axial corridors. This in turn has produced directional-flow balances. During peak hours, 55 percent of Stockholm's rail-commuters are typically traveling in one direction on trains and 45 percent are heading in the other direction. As impressive, Stockholm is one of the few places where automobility appears to be receding. Between 1980 and 1990, it was the only city in a sample of 37 global cities that registered a per capita decline in car use -- a drop off of 229 annual kilometers of travel per person (Kenworthy and Laube, 1999).

Copenhagen regional vision of TOD took the form of the celebrated "Finger Plan" – five well-defined linear corridors, each oriented to a historical Danish market town. As importantly, greenbelt wedges set aside as agricultural preserves, open space, and natural habitats were also designated and accordingly major infrastructure was directed away from these districts. The evolution of Copenhagen from a Finger Plan, to a directed rail-investment program along defined growth axes, to finger-like urbanization patterns is revealed by Figure 2.2.

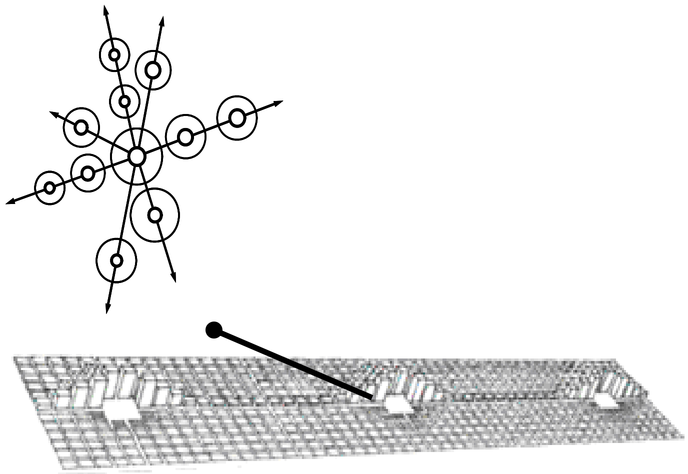

Figure 2.1. TODs as "Necklaces of Pearls"

Figure 2.2. Copenhagen: From Finger Plan, to Five-Axis Radial Investment, to Corridors of Satellite, Rail-Served New Towns

2.3 The 5 Ds of TOD

In terms of their physical make-up, TODs feature what has been referred to as the three dimensions, or "3 Ds", of sustainable development: density, diversity, and design (Cervero and Kockelman, 1997). Density means having enough residents, workers, and shoppers within a reasonable walking distance of transit stations to generate high ridership. Diversity calls for a mixture of land uses, housing types, building vernaculars, and ways of circulating within neighborhoods. And design embodies physical features, site layouts, aesthetics, and amenities that encourage walking, biking, and transit riding as well as social engagement.

The 3Ds, of course, are hardly independent of each other – indeed, most mixed-use neighborhoods have plentiful pedestrian amenities and are fairly compact. The 3Ds, then, might be viewed as overlapping spheres, or Venn Diagrams, of high-quality and sustainable urban environments (Figure 2.3).

Two additional dimensions – "distance to transit" and "destination accessibility – can be added to the list, forming the "5 Ds" of the built environment (Figure 2.3). Studies show ridership among residents and workers often tapers exponentially with distance from a railway station (Holtzclaw et al., 2002; Cervero et al., 2002). In the case of residences, this is often a product of self-selection – for lifestyle reasons, some chose to rent or purchase a residence within easy access to transit for the very reason they prefer to take the train to work or other destinations than drive (Cervero, 2007). Destination accessibility pertains to how well a TOD is connected to retail shops, activity centers, and other popular destinations. It thus captures the degree to which public transport efficiently connects a station-area neighborhood to activities spread throughout a region.

Most neighborhoods around MTR's railway stations clearly feature many, if not all, the 5D characteristics of TOD. With among highest densities in the world, retail shopping intermixed with offices and residential towers, and numerous pedestrian pathways and skybridges that interlace buildings, all MTR stations and their surroundings embody the 3Ds – density, diversity, and design – to some degree. And with building heights that taper with distance from stations (wedding-cake style) and connected to other parts of the territory by two extensive urban railway network, most MTR stations and R+P projects as well engender features of all 5Ds. A good example is Maritime Square, planned and managed by MTRC as part of the development of Tsing Yi station airport line. The mixed-use Maritime Square R+P project boasts a seamless integration between the railway station and shopping center as well as the above-station residential towers (Figure 2.4). Residents can experience a 'temperature-controlled" environment – able to go from their luxury apartments to shopping below and then directly into the MTR station without stepping outdoors. Maritime Square came to fruition because the opportunities for physical integration were assessed at the master planning stage (Tang et al., 2004).

However, most MTR stations and associated R+P projects are not like Tsing Yi Station and Maritime Square. They vary owing to differences in topography and geographical settings, histories and timing of development, socio-demographic characteristics, real-estate market vitality, and neighborhood attitudes and sentiments. Accordingly, they vary enough across these 5D dimensions to create different physical environments and potentially different real-estate market characteristics and ridership performance. For this very reason, a typology of MTR's stations with R+P projects is developed in the next chapter, built along the lines of the 5Ds.

Possessing the 5Ds does not necessarily mean development is "oriented" to transit. In the United States, the "tag" of TOD has come under attack by those who contend that buildings erected near U.S. transit nodes do not always have any kind of functional relationship to a station. Big commercial boxes enveloped by abundant, free parking do not constitute TOD regardless how close they might be to a station. Such Transit Adjacent Development (TAD) characterizes a lot of commercial activities near suburban rail stations in the United States (Photo 2.1). Urban designs, and particularly attention to the needs of the pedestrians (since all transit users are pedestrians to some degree), are often what determines whether development is "oriented" versus "adjacent" to transit. While TAD is less prevalent in Hong Kong due to the scarcity of land and thus the need to carefully integrated development, there are nonetheless missed opportunities to integrate surrounding development with MTR and former KCR stations, particularly in the case of some older stations and commercial projects. These are discussed later in the report in the case study analyses in Chapter Four.

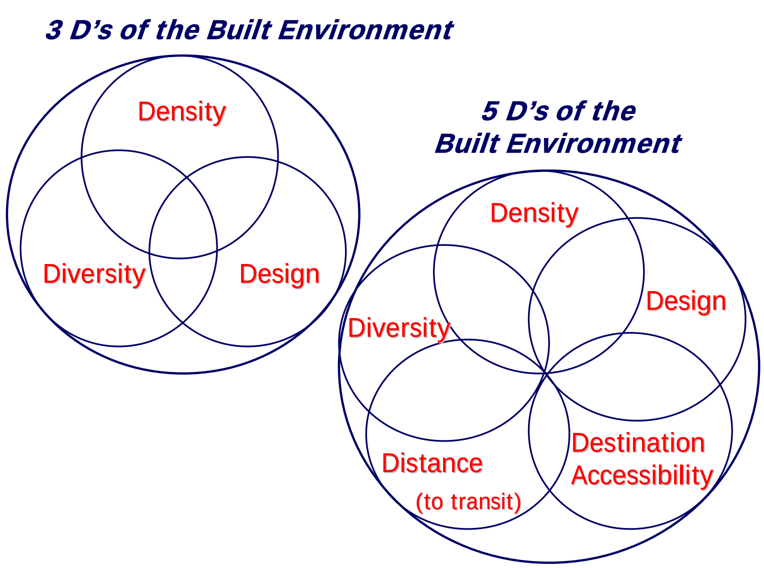

Figure 2.3. Three & Five "D's of Built Environments: Density, Diversity, Design, Destination Accessibility, and Distance to Transit

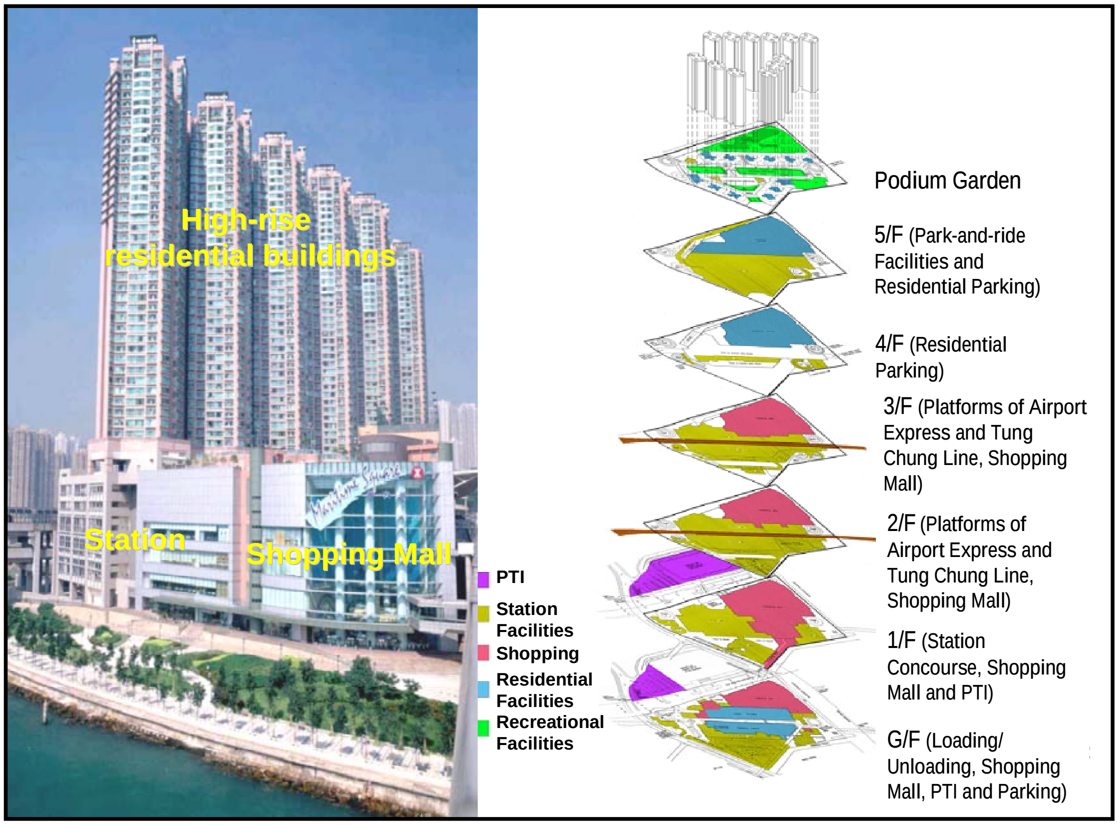

Figure 2.4. Maritime Square Residential-Retail Development Atop Tsing Yi Station. Maritime Square features hierarchically integrated uses. Shopping mall extends from the ground floor to the 3rd level. Station concourse sits on the 1st floor, with rail lines and platforms above and ancillary/logistical functions (like public transport/bus interchange and parking) at or below. Above the 4th and 5th floor residential parking lies a podium garden and above this, high-rise, luxury residential towers.

2.4 TOD as Place-making

TOD is more than bricks and mortar or some fanciful architectural vision. At its core, TOD is about place-making. In the book *Transit Villages for the 21st Century*, Bernick and Cervero (1997, p.5) cast TOD in such place-making terms:

> The centerpiece of the transit village is the transit station itself and the civic and public spaces that surround it. The transit station is what connects village residents and workers to the rest of the region, providing convenient and ready access to downtowns, major activity centers like sports stadium, and other popular destinations. The surrounding public spaces or open grounds serve the important

function of being a community gathering spot, a site for special events, and a place for celebrations – a modern-day version of the Greek agora.

Photo 2.1. TAD: Transit Adjacent Development in San Jose, California's Silicon Valley. Light-rail station in roadway median, separated from surrounding buildings, all of which are spread-out, single-use employment centers enveloped by surface parking.

Among the adjectives often used by contemporary urban designers to describe high-quality, transit-friendly places are:

- *Comfortable*: a human-scale setting whereby people are not overwhelmed by the height of buildings, robbed of daylight by the cast of shadows, or excessively subjected to such elements as wind eddies. Comfort is particularly important for rail station areas where real-estate markets exert pressure to maximize profits by increasing densities at and near station entrances.
- *Memorable:* interesting milieus that instinctively draw people to them, often by highlighting an area's distinctive history, culture, architecture, or natural features.
- *Aesthetic and amenities*: a strong accent on livability through high-quality and coordinated urban designs, ample landscaping and greenery, display of the arts, and preservation of natural features; aesthetics become all the more important in TODs so as to soften peoples' perceptions of surrounding densities.
- *Connectivity*: the ability to freely and seamlessly interconnect to nearby places in an efficient, pleasant, and safe manner.
- *Legibility*: visual cues, building orientations, signage, and clear site lines that allow people to easily "read" their environs and thus reach desired destinations in a timely, predictable manner.

- *Natural surveillance*: lively, vibrant settings of social interaction that puts "eyes on the street" so as to provide a collective sense of security and self-policing.

The idea that TOD is more than an assembly of buildings around transit nodes also speaks to its social and cultural context. Some observers make the case that TOD provides an opportunity to build social capital – i.e., encouraging social interaction and strengthening the bond between people and the communities in which they live, work, and play (Dittmar and Ohland, 2004). Building upon the seminal writings of Putman (2000), the hope and expectation is that by allowing more face-to-face interaction and public engagement, TOD can play a role in promoting good citizenship, providing "eyes on the street" as a means to reduce crime, promoting volunteerism like participation in neighborhood clean-up drives, and greater sensitivity to the difficulties faced by some segments of society, like the elderly and poor. TODs can also create lively urban districts, the kinds of places people are naturally drawn to. In this vein, Bertolini and Spit (1998) note TODs exploit the synergies between railway and communities, turning the transit station into a "place to be" rather than "a place to pass through".

We can again turn to Scandinavian experiences to gain insights into design elements that enhance TOD's role as place-making. In greater Stockholm, many rail stations are physically and symbolically the hub of the community. In most master-planned new towns, like Vällingby and Skarholmen, the rail stop sits squarely in the town center (Cervero, 1998). Upon exiting the station, one steps into a car-free public square surrounded by shops, restaurants, schools, and community facilities. The civic square, often adorned with benches, water fountains, and greenery, is the community's central gathering spot – a place to relax, socialize, and a setting for special events, whether national holidays, public celebrations, parades, or social demonstrations (Photo 2.2). Sometimes, the square does double duty as a place for farmers to sell their produce or street artists to perform, changing chameleon-like from an open-air market one day to a concert venue the next. The assortment of flower stalls, sidewalk cafes,

Photo 2.2. TOD Public Square, Vällingby, Stockholm County, Sweden. A pedestrian-friendly, car-free civic square functions as Vällingby's town center. The accent on livability is showcased by street furniture and benches, flower plantings, water fountains, public art, cobblestone walkways, and an assortment of ground-level retail shops. Stockholm's Tunnelbana subway entrance is to the left (identified by the round "T" sign).

newsstands, and outdoor vendors dotting the square, combined with the musings and conversations of residents sitting in the square, retirees playing chess, and everyday encounters among friends, adds color and breathes life into the community.

This characterization of TOD as a socially engaging "village" wrapped around a railway station is most pertinent to neighborhoods where residences are the dominant land uses. Although built at much higher densities than might be considered a "village", and certainly well above those in rail-served Scandinavian suburbs, MTR stations like Kowloon Bay and Tung Chung nonetheless impart a sense of place. They do this in part by creating a significant public space outside the station that functions as a casual community gathering place. Tung Chung station and its adjacent civic square, for instance, is today the centerpiece of the Tung Chung new town and according to Tang et al. (2004, p. 27) "it has the potential to become Hong Kong's landmark gateway from visitors arriving at the airport" (Photo 2.3).

Photo 2.3. Tung Chung Station Environment. Open space and attractive landscaping separates the MTR station from nearby residential towers.

As discussed in the case studies in Chapter Four, many of MTR's newer station areas, like Tung Chung, are of a human scale, featuring bright night lights, openness (much appreciated in a hyper-dense city), vivid and coordinated urban designs, and through active pedestrian movements, the kind of natural surveillance that gives people a sense of comfort.

2.5 Urban TODs and Joint Development

TODs need not be predominantly residential in their make-up. Urban TODs typically have more of an office and commercial orientation. Concentrating retail centers and job sites in and around stations is every bit as important to promoting transit ridership as concentrating residential towers. Without the "destination" end of a trip also conveniently served by transit, residential TODs will not yield high ridership dividends. All of the world's most successful transit metropolises – Stockholm, Copenhagen, Tokyo, Singapore -- complement residential TODs with urban centers interlinked by high-quality, high-capacity rail transit (Cervero, 1998). Among MTR stations that play this important complementary role as primary destinations are Central, Hong Kong, Admiralty, Quarry Bay, and Sheung Wan. Hong Kong station, for example, not only functions as a major office-retail-hotel complex in the urban core, but also an intermodal connection point, offering transport interchange (including check-in for and express connections to the International Airport) (Figure 2.5).

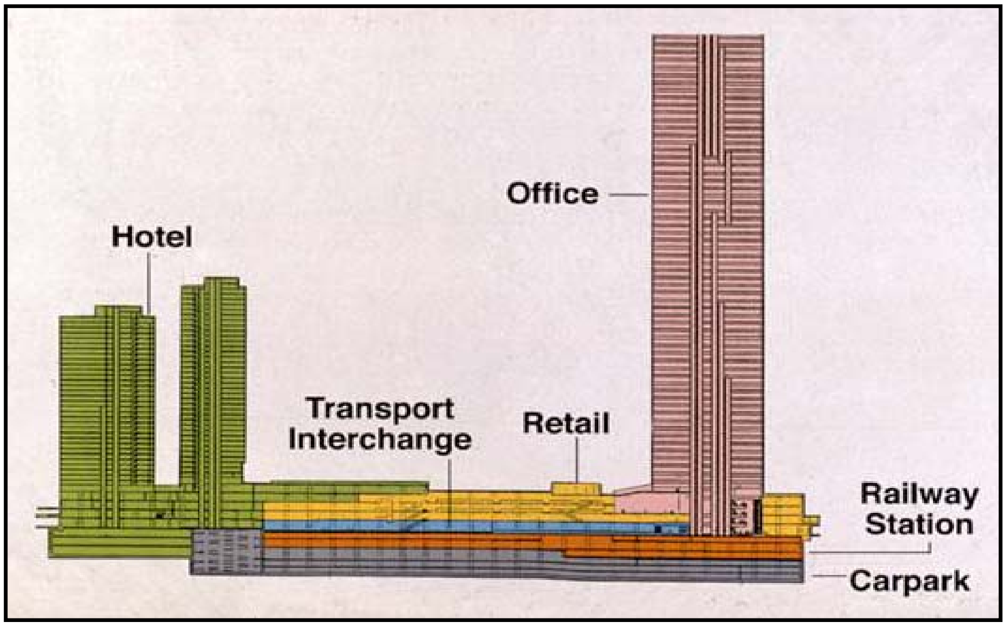

Figure 2.5. Mixed-Use, Inter-modal Activities at MTRC's Hong Kong Station

Urban TODs have the potential to spin off secondary economic benefits such as providing opportunities for joint development (e.g., building a retail store adjacent to a transit station and generating lease revenues for a transit agency) (Bernick and Cervero, 1997). In many ways, TOD is a secondary "spin off" of the R+P model's financial focus – that is, high-quality and sustainable urbanism is an important by-product.

Technically, joint development can be but is not always TOD and most TOD is not joint development. Transit joint development is distinguished from TOD mainly by being tied to a specific real-estate project, venture, or brokered deal between a public entity (like a transit agency) and one or more private interests. Joint development normally occurs on a transit agency's property or in its air rights (Cervero et al., 2004). Globally, the inventory of joint development at transit stations include air-rights development, ground-lease arrangements, station interface or connection-fee programs, and other initiatives that promote real-estate development at or near transit stations to the mutual benefits of public and private interests.

At its core, joint development operates on the principle of 'quid pro quo' – developers obtain the right to develop station land by making a direct payment (purchase, and lease, capital contribution, development fee). By enabling public-private partnership, joint development not only allows capital costs to be covered but also provides an opportunity for implementing a comprehensively master-planned development project with a high-quality urban design that entices additional private investment.

As a "win-win" arrangement MTRC's R+P projects are akin to transit joint development, although instead of leasing land to private developers, as in the case with joint development in the U.S. and many other parts of the world, MTRC often sells development rights outright to qualified and successful private bidders. Regardless, the outcome is the same: integrated rail and property development that is financially remunerative. Of note, both approaches operate on the core principle of value capture – reaping the financial benefits created by the accessibility gains made possible through public-sector investments in rail transit.

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Part II
Analysis of R+P:
Typologies, Case Studies,
Performance Impacts, and Regional Context

What types of R+P projects have evolved over time, how well are they integrated into surrounding communities, and to what degree do they influence MTR ridership and real-estate market performance? These are among the questions addressed in the second part of the report. Chapter Three creates two typologies of R+P projects: one based on built-environment characteristics of R+P projects, such as density, scale, and land uses; the other based on housing characteristics and development patterns. Associations between types of R+P projects and ridership patterns are examined. Chapter Four presents qualitative case studies of projects for each R+P type. Through field surveys, urban design and the quality of walking environments are assessed. Partnership arrangements for constructing, managing, and sharing of costs and profits are also discussed for each case. Chapter Five also presents case studies of R+P, however the focus is how newer generation projects based on transit-oriented design principles compare to earlier ones which were motivated almost exclusively by financial concerns. Ridership patterns are contrasted between newer and older R+P projects. The sixth chapter focuses explicitly on the influences of R+P on MTR patronage as well as housing prices. Statistical models are estimated that gauge the influences of R+P as well as transit-oriented development on these outcomes. Chapter Seven closes out Part II with a more macro-scale perspective, examining the role of R+P in achieving regional development objectives, such as new town development, land conservation, and urban regeneration. As Hong Kong continues to experience economic restructuring toward a more service-based economy, the R+P approach is well-positioned to guide the urban transformation process.

Chapter Three
R+P and Station-Area Typologies: Built Environments and Housing Development

3.1 Typologies of R+P Projects

While most R+P projects tower above or besides MTR stations, they are hardly one in the same. Indeed they vary by land uses, building densities, site designs, connectivity to surrounding neighborhoods, inter-modal provisions, and the degree of integration with station concourses. Like most TODs, R+P projects are not monoliths; they vary place to place.

This chapter aims to shed light on the different types of R+P projects, primarily with regards to built environments, using the 5Ds introduced in Chapter Two. A typology is also constructed on housing projects within 500 meters of MTR stations with regard to factors like type (e.g., privately owned or publicly subsidized), density, and proximity to stations. The primary reason for constructing these typologies is descriptive – i.e., to classify projects based on their shared characteristics. A secondary objective is normative: to gain insights into how ridership varies among types of R+P projects and housing developments. Additionally, some of the analyses in later chapters, in particular case-study discussions of R+P designs (Chapter Four), draw upon these classifications – e.g., case study examples are presented for each R+P type.

Classification is one of the oldest pursuits of humankind. Whether used for studying buildings, neighborhoods, cars, or animal species, classification is a useful tool for distilling large volumes of information into more interpretable subgroups. Borrowing an idiom, it helps one "see the forest through the trees".

3.2 R+P Typology: Built Environments

What types of land-use environments and density profiles characterize R+P projects? To address this question, data were compiled for each of 25 MTR stations with R+P projects as of late-2006. For each R+P site, in-house data were obtained from MTRC on:

- building area (in gross floor area, or GFA) by use (residential, office, retail shopping, hotel/service apartments, and other);
- scale (size of site in hectares and total gross floor area of development);
- density (plot ratio = building area/land area) and verticality (height of buildings);
- mix-use attributes (heterogeneity index, ranging from 0 for single-use settings to 1 for maximally mixed-use settings).[1]

Among the 5Ds discussed in Chapter Two, these variables largely capture Density (e.g., plot ratio) and Diversity (e.g., land-use mixing). While initial efforts were made to compile Design metrics (such as pedestrian connectivity indices and measures of sidewalk completeness) for R+P projects, this proved difficult – not only because of the unavailability of pre-collected data but also because of the inherent subjectivity of the subject matter. For this reason, the decision was made not to include design measures in constructing the typology but instead to conduct separate case-study analyses of R+P projects focused on urban design elements (presented in the next chapter).

In building a typology, the statistical technique of cluster analysis was used. The process involved combining cases into clusters on the basis of their similarity across built-environment variables. The process involves iteratively combining similar-like cases to form a limited set of clusters.[2] A tree diagram, called a dendogram, of R+P projects that were iteratively joined on the basis of their shared land-use and density attributes is shown in Figure A.1.1 of Appendix A.[3]

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[1] This was based on the measurement of an Entropy Index = $\{ -\Sigma_k [(p_i) (\ln p_i)]\}/(\ln k)$ wherein: $(0 \le EI \le 1)$ and K = # of Land use types (in this case, K=5); p_i: GFA-based proportion of land use in type i; and i : Land use type (residential, office, retail, hotel and others).

[2] The process involved combining cases into clusters on the basis of their "nearness" to each other when expressed as squared Euclidean distances. Using the technique of agglomerative hierarchical clustering, clusters were sequentially formed by grouping cases into even larger clusters until all R+P cases were members of a single cluster.

[3] The dendogram shows the clusters being sequentially combined and the normalized values of the coefficient (i.e., squared Euclidean distances) at each step. The judgmental part of cluster analysis is deciding at what stage to stop joining clusters. This is normally done when the distance coefficients dramatically increase from one agglomeration step to another. Visually, this is before the horizontal lines (denoting the joining of clusters) in the dendogram become noticeable longer (approximately in the middle of the graph between "rescaled distance cluster combine" scores of 10 and 15.

Five types of R+P projects were found among the 25 MTR stations. (Two stations with R+P projects were not grouped into clusters because of their idiosyncratic and thus uncharacteristic nature, thus they were treated as "ungrouped"). The titles assigned to these five types of R+P projects based on their built-environment attributes are as follows:

- *High-Rise Office (HO)*: high-rise, predominantly office uses on small sites;
- *High-Rise Residential (HR)*: high-rise, predominantly residential uses on small sites;
- *Mid-Rise Residential (MR):* medium-density, predominantly housing projects on medium-size plots;
- *Large-Scale Residential (LR):* predominantly residential uses on large sites with comparatively low plot ratios; and
- *Large-Mixed Use (LM):* mixture of housing, offices, retail, hotels, and others on large sites with medium plot ratios.

Figure 3.1 maps the locations of these five R+P prototypes (spread among 25 MTR stations). Figure 3.2 summarizes the built-environment features of each type by presenting statistical averages for the variables used to form clusters – i.e., plot ratios, scale (GFA of building area), site area, and land use mixes (expressed in both pie-chart form and as a 0-1 "entropy" mixed-use index). Figure 3.2 also lists the stations which belong to each R+P prototype.

Differences in the built environments of each class of R+P stations are highlighted in Figure 3.2. Among the five prototypes, average plot ratios range from a high of 14.84 ("High-Rise Offices") to a low of 3.51 ("Large-Scale Residential") – i.e., more than a four-fold differential. In terms of total GFA, "Large-Scale Residential" projects like Tung Chung and Kowloon Bay tend to be the biggest in size, with a mean GFA of 670,000 square meters, owing to their typically large land tracts (on average, 19.5 hectares). "High-Rise Offices", found mostly in the historical urban core of Hong Kong island, on the other hand, tend to be on comparatively small sites (mean = 0.40 hectares) and for this reason, average the lowest gross floor building area (mean = 59,700 square meters).

Based on both the pie charts and mixed-use (entropy) indices in Figure 3.2, R+P projects are also seen to vary markedly in terms of land-use mixes. As indicated by title, the "Large-Scale Mixed Use" type of R+P project is the most diverse. Among the three stations in this category (Kowloon, Tseung Kwan O, and Hong

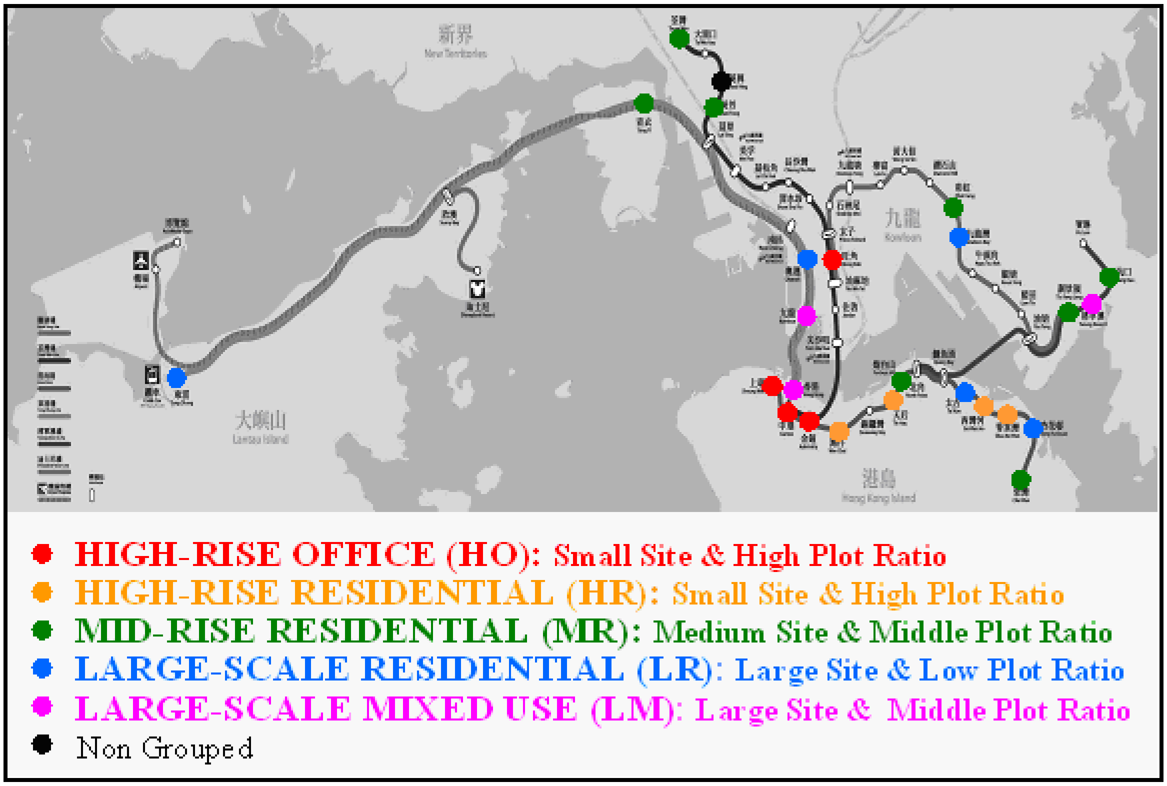


Figure 3.1. Locations of R+P Projects by Built Environment Types

Kong), on average 40.5% of GFA is devoted to housing and 28% for office uses, followed by 20% for other activities (like hotels, government functions, and recreational facilities) and 11.4% for retail shopping.

3.3 Station-Area Typology: Housing Patterns

Given the focus given to residential development around MTR stations, a second typology was constructed based on housing types and designs. Using 2001 (the most recent available) census data on housing, the following variables were recorded for 500 meter catchments of the 50 MTR stations that existed that year:

- Number of housing units within distance rings of 0-80m, 80-200m, and 200-500m of stations;
- Share of housing units within 500m by type: private (market-transacted and generally highest quality housing); public (rental units at comparatively low prices); and subsidized (government-provided housing sold at a discounted price); and

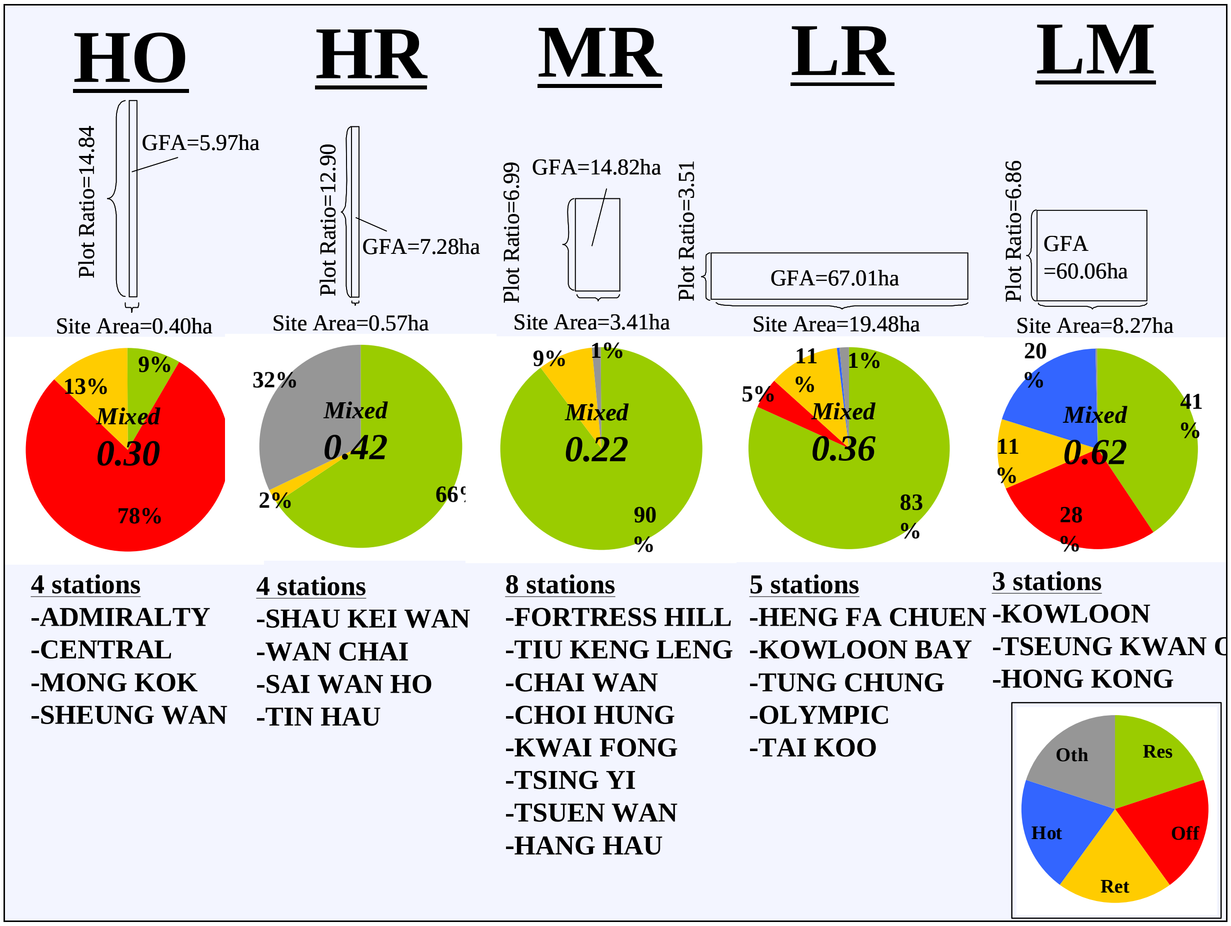


Figure 3.2. Listing of MTR Stations in each Built-Environment Type and Statistical Mean Statistics for key clustering variables.

- Average household size within 500m distance ring.

A hierarchical clustering routine was used to construct the typology, producing the dendogram shown in Figure A.1.2 in Appendix 1.

In all, six distinct types of housing development were found among MTR stations.[4] These are summarized in Figure 3.3. Briefly, the six housing types are as follows:

[4] Disneyland Resort and Sunny Bay were not included in the typology because no housing existed around these stations in 2001. Additionally, the Mei Foo station is omitted from the analysis because of the idiosyncratic nature of its housing (large-scale housing but private units).

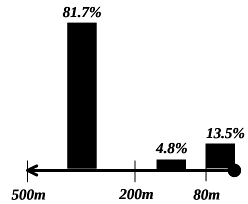
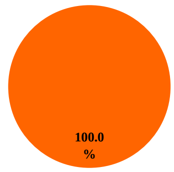
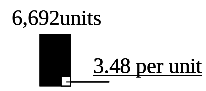
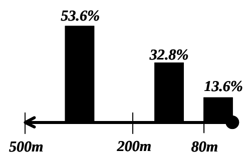
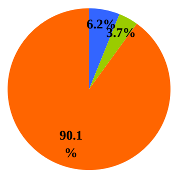
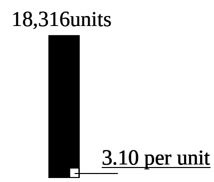
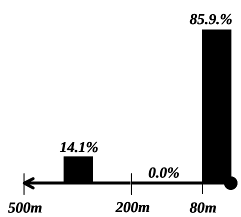
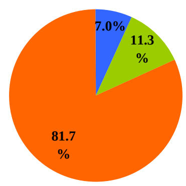
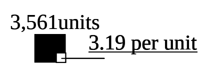
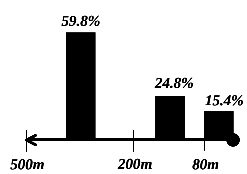
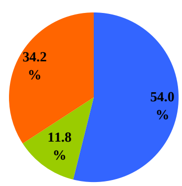
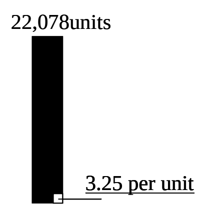
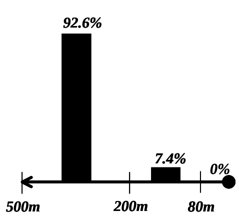
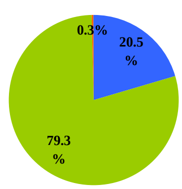
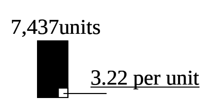
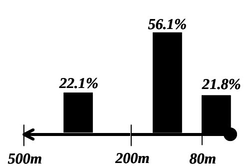
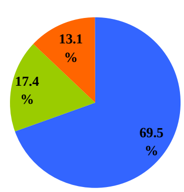
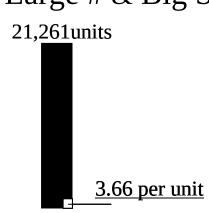
Housing Pattern	Ownership Type	Scale and Size	Stations
Donut 	Private 	Small # & Big Size 	3 stations ADMIRALTY CENTRAL SHEUNG WAN
Even Spread 	Private 	Large # & Small Size 	*17 stations
Core Housing 	Private 	Small # & Small Size 	4 stations HENG FA CHUEN KOWLOON LAI CHI KOK TUNG CHUNG
Even Spread 	Private-Public 	Large # 	**17 stations
Donut 	Subsidized 	Small # 	2 stations TIU KENG LENG TSEUNG KWAN O
Near-Station Housing 	Public 	Large # & Big Size 	4 stations CHOI HUNG HANG HAU KWAI HING LAI KING

Figure 3.3. Typology of Housing Developments Around MTR Stations

Note:

*** 17 stations**	**** 17 stations**
CAUSEWAY BAY	CHAI WAN
FORTRESS HILL	CHEUNG SHA WAN
HONG KONG	DIAMOND HILL
JORDAN	KOWLOON BAY
MONG KOK	KOWLOON TONG
NORTH POINT	KWAI FONG
OLYMPIC	KWUN TONG
PRINCE EDWARD	LAM TIN
QUARRY BAY	LOK FU
SAI WAN HO	NGAU TAU KOK
SHAM SHUI PO	PO LAM
TAI KOO	SHAU KEI WAN
TIN HAU	SHEK KIP MEI
TSIM SHA TSUI	TAI WO HAU
TSUEN WAN	TSING YI
WAN CHAI	WONG TAI SIN
YAU MA TEI	YAU TONG

Figure 3.3. (Continued). Typology of Housing Developments Around MTR Stations

1) *Private, Small-Scale, "Donut" Pattern Housing*: Three station areas (Admiralty, Central, and Sheung Wan) have exclusively private housing, comprising relatively small numbers of units (on average, 6,692 within 500m), most of which are away from the station – i.e., a "donut" pattern in that there is a "hole" in the center, near the station, with most housing in the 200-500 distance ring.

2) *Predominantly Private, Large-Scale, Evenly Spread Housing:* The most MTR stations (17 in all) have predominantly (on average, over 90%) private housing in large-scale projects (on average, 18,316 units) and comparatively small household sizes. These units tend to be more evenly distributed within the 500 meter station catchment – while most (53.6%) of housing is in the 200-500 m distance ring, since this ring is much larger in area, the housing tends to be more evenly spread than in most station settings.

3) *Predominantly Private, Small-Scale, Core Housing*: Four station areas (Heng Fa Chuen, Kowloon, Lai Chi Kok, and Tung Chung) feature predominantly private housing (on average, 81.7%), in small-scale projects (on average, 3,561 units), and concentrated near the station (around 86% lies within 80m of stations).

4) *Mixed, Large-Scale, Evenly Spread Housing*: Seventeen station areas average the widest mix of private, public, and subsidized housing, generally of a large scale (on average, 22,078 units) and fairly evenly spread within the 500m station catchment.

5) *Predominantly Subsidized, Small-Scale, "Donut" Pattern Housing*: Two stations (Tiu Keng Leng and Tseung Kwan O) are characterized by mainly subsidized, fairly small-scale housing that is situated mainly away from the station (i.e., in a donut-shaped pattern).

6) *Predominantly Public, Large-Scale, Near-Station Housing*: Four station areas (Choi Hung, Hang Hau, Kwai Hing, and Lai King) feature predominantly public housing of a fairly large scale, with comparatively large household sizes, and physically fairly close to stations (78% lies within 200 meters).

Does housing development differ among MTR stations with R+P stations and those without? Does it differ among the five types of R+P station settings? These questions were explored by cross-tabulating the data from the two cluster analyses. Table 3.1 shows the results. Compared to "non-R+P" stations, those with R+P projects tend to:

Table 3.1. Arithmetic Means of Housing Statistics for MTR Stations with R+P Projects: Comparison to Non-R+P Stations and Among Five R+P Built-Environment Types

	Housing Units Within 500m	Housing Units Distribution within 500m (%)			Housing Units Share by Supply Type (%)			Residents per Unit
		500-200	200-80	80-0	Public	Subsidized	Private	
25 R+P	**17,433**	**51.7**	**26.3**	**21.9**	**23.3**	**16.2**	**60.4**	**3.07**
HO (high-rise offices)	**10,398**	**77.0**	**10.6**	**12.4**	**0.0**	**0.0**	**100.0**	**3.44**
HR (high-rise residential)	**20,607**	**51.0**	**33.0**	**16.1**	**19.6**	**9.8**	**70.7**	**2.48**
MR (mid-rise re sidential)	**20,922**	**56.7**	**34.4**	**9.0**	**36.1**	**27.5**	**36.4**	**2.97**
LR (large-scale residential)	**20,442**	**32.7**	**19.0**	**48.3**	**19.2**	**15.9**	**64.9**	**3.21**
LM (large-scale mix-uses)	**5,333**	**46.2**	**15.6**	**38.2**	**13.6**	**19.7**	**66.7**	**3.26**
26 Non R+P	**15,617**	**50.8**	**24.4**	**17.2**	**32.8**	**5.1**	**54.5**	**3.39**
51 Station Total	**16,507**	**51.2**	**25.3**	**19.5**	**28.1**	**10.5**	**57.4**	**3.23**

- have more housing units within 500 meters;
- have higher shares of housing clustered within 80 meters of stations (21.9% versus 17.2%);

- have higher shares of private housing and substantially lower shares of subsidized housing; and

- average smaller household sizes, indicating fewer children per household.

Among types of R+P projects, Table 3.1 reveals:

- housing was most concentrated in station areas with large-scale residential R+P projects and least concentrated in areas with predominantly high-rise offices;

- the strongest private-housing orientation was in stations areas with high-rise office and high-rise residential housing, while the largest shares of public and subsidized housing was in station areas with mid-rise residential R+P projects; and

- the largest household sizes were in station areas characterized by high-rise office R+P projects and the smallest were in those with predominantly high-rise residential R+P projects.

3.4 Typologies and Ridership Performance

As noted earlier, part of the logic behind building a typology of R+P projects and station-area housing was to explore whether MTR ridership varied significantly among groupings. One hypothesis explored was whether stations with more mixed-use R+P projects and land-use patterns experienced a more even distribution of riders within the weekday (i.e., peak and off-peak) and between weekdays and weekends. Notably, settings with shopping and retail inter-mixed with housing and offices could be expected to generate rail trips that are more evenly distributed. Moreover, one might expect a balance of travel flows in mixed retail-office-housing settings – i.e., stations functions as both trip origins and destinations at all hours of the day. Experiences with mixed-use TODs in settings as varied as Arlington, Virginia and Stockholm, Sweden generally bear out these hypotheses: more balanced, mixed-use environments produced more balanced transit demand (Cervero, et al., 2004). Does the same hold in Hong Kong?

An analysis of mean statistics on ridership, ridership growth (2001-2005), and various balance indices revealed no strong pattern among stations based on types of R+P project. This is revealed by Table 3.2

Compared to Non-R+P stations, Table 3.2 shows that stations with R+P projects:

- averaged lower weekly ridership but experienced substantially higher ridership growth between 2001 and 2005 (13.2% versus 8.8%);
- had proportionally more peak-morning than peak-evening ridership;
- had similar shares of station entries and exits in the morning as well as balance between weekday and weekend ridership; and
- were comparably accessible to the Central Station (i.e., both groups averaged 17 minutes peak-period travel to the Central Station).

Among the five classes of R+P stations, Table 3.2 shows:

- substantially higher weekly ridership for high-rise office R+P stations;
- dramatically faster ridership gains for large-scale mixed-use R+P stations; and
- the most balance in peak-period station entries and exits at large-scale residential stations.

While ridership patterns do not vary dramatically by types of R+P station settings and the balanced-flow hypotheses for mixed-use settings were not borne out, the finding of substantially healthier ridership gains for stations with R+P projects versus those without suggests R+P stations could be producing more than direct financial benefits to MTRC. The gains in farebox receipts from ridership growth might be a side benefit. Moreover, none of these typologies presented in this chapter reflect urban design characteristics and thus the TOD-like pedestrian-orientation of many R+P projects. In Chapter Four, the influence of R+P projects, and in particular TOD designs, on ridership is explored further. But first, it is useful to gain greater insights into the urban design characteristics and pedestrian provisions of R+P projects and their station surroundings. For this purpose, we turned to case studies, the focus of the next chapter.

Table 3.2. Arithmetic Means of Housing Statistics for MTR Stations with R+P Projects: Comparison to Non-R+P Stations and Among Five R+P Built-Environment Types

	Weekly Ridership	Ridership Change (%)	AM/PM Balance	In & Out Balance Index		Weekday/ Weekend Balance	Travel Time (Min.)
				AM	PM		
25 R+P	**635,091**	**13.2**	**1.16**	**0.62**	**0.74**	**1.65**	**17**
HO (high-rise offices)	**1,125,397**	**3.5**	**0.80**	**0.53**	**0.57**	**1.82**	**4**
HR (high-rise residential)	**522,468**	**7.3**	**1.13**	**0.55**	**0.75**	**1.65**	**12**
MR (mid-rise r esidential)	**651,144**	**15.4**	**1.23**	**0.58**	**0.77**	**1.58**	**22**
LR (large-scale residential)	**519,049**	**10.0**	**1.29**	**0.78**	**0.86**	**1.59**	**22**
LM (large-scale mix-uses)	**361,539**	**67.0**	**1.30**	**0.59**	**0.68**	**1.63**	**14**
26 Non R+P	**670,888**	**8.8**	**1.07**	**0.64**	**0.74**	**1.64**	**18**
51 Station Total	**653,341**	**10.9**	**1.11**	**0.63**	**0.74**	**1.64**	**17**

Note:

- *Weekly Ridership*: number of weekly riders, 2005
- *Ridership Change*: Percent increase in weekly ridership, 2001 to 2005
- *AM/PM Balance*: (AM ridership/PM ridership) on weekdays, 2005
- *In & Out Balance Index* = $1 - \frac{|In - Out|}{In + Out}$ where "In" equals station entries and "Out" equals station exits; computed for both AM and PM peaks. Ranges from 0 to 1, with 0 indicating maximum skewness (i.e., only entries or exits) and 1 denoting maximum balance (comparable counts of entries and exits).
- *Weekday/Weekend Balance*: [5 weekday ridership/ (weekend ridership * 2.5)]
- *Travel Time*: Travel time to Central Station (minutes)

Reference

Cervero, R., S. Murphy, C. Ferrell, N. Goguts, Y. Tsai. 2004. *Transit Oriented Development in America: Experiences, Challenges, and Prospects*. Washington, D.C.: Transportation Research Board, TCRP Report 102.

Chapter Four

Case Studies of R+P Projects: Urban Design and Partnership Arrangements

4.1 Case Sites and Data Collection

To gain insights into the urban designs of R+P projects and their surroundings as well as partnership arrangements, case studies were carried out. In consultation with MTR planning staff, one representative case from each of the five R+P prototypes was selected. Additionally, as a basis of comparison, cases were chosen from two other settings: MTR stations without R+P projects and Hong Kong neighborhoods without MTR services. Table 4.1 lists the chosen case study sites. Five stations with R+P projects were studied, spanning the five R+P prototypes. Figure 4.1 shows the locations of these five projects. Table 4.1 also lists the three non-R+P stations that were studied: one with mainly office uses (Quarry Bay), one with predominantly residential uses (Ngau Tau Kok), and one with mixed offices and retail (Causeway Bay). The two non-MTR-served neighborhoods were chosen to represent both urban and suburban-like settings.

For each case-study site, a "Quality of Catchment Area" survey was conducted in mid-May 2007. In consultation with MTRC planning staff, between 3 and 5 walking corridors were chosen that connected the MTR station (or community center for non-rail neighborhoods) to a destination on or near the edges of a 500 meter radius from the station. Figure 4.2 shows the selected walkway corridors for two case-study sites: Hong Kong and Causeway Bay stations. The field surveyor walked the entire distance of each corridor, taking photographs and recording information on: walking distance; sidewalk and footbridge provisions; signage; retail/consumer-service provisions and activities; pedestrian circulation; multi-modal connections and provisions for motorized vehicle access; and open space, landscaping and pedestrian amenities. Appendix 2 presents the recorded survey results for each case along with photographs and a map showing building locations and walking corridors.

In the course of studying the five R+P stations, information was also obtained on partnership arrangements – notably the roles of public and private-sector stakeholders in project construction and management, mechanisms for sharing costs and profits, and asset ownership. Section 4.5 of this chapter presents these findings.

Table 4.1. Case Study Sites

R+P Cases		Non R+P Cases		Non-Station Cases	
MTR Station	R+P Type	MTR Station	Primary Land Use	Neighborhood	Setting
Admiralty	High-Rise Office (HO)	Quarry Bay	Office	East Sim Sha Tsui	Urban
Tin Hau	High-Rise Residential (HR)	Ngau Tau Kok	Residential	South Horizons	Suburban
Hang Hau	Mid-Rise Residential (MR)	Causeway Bay	Office & Retail		
Tung Chung	Large-Scale Residential (LR)				
Hong Kong	Large-Scale Mixed Use (LM)				

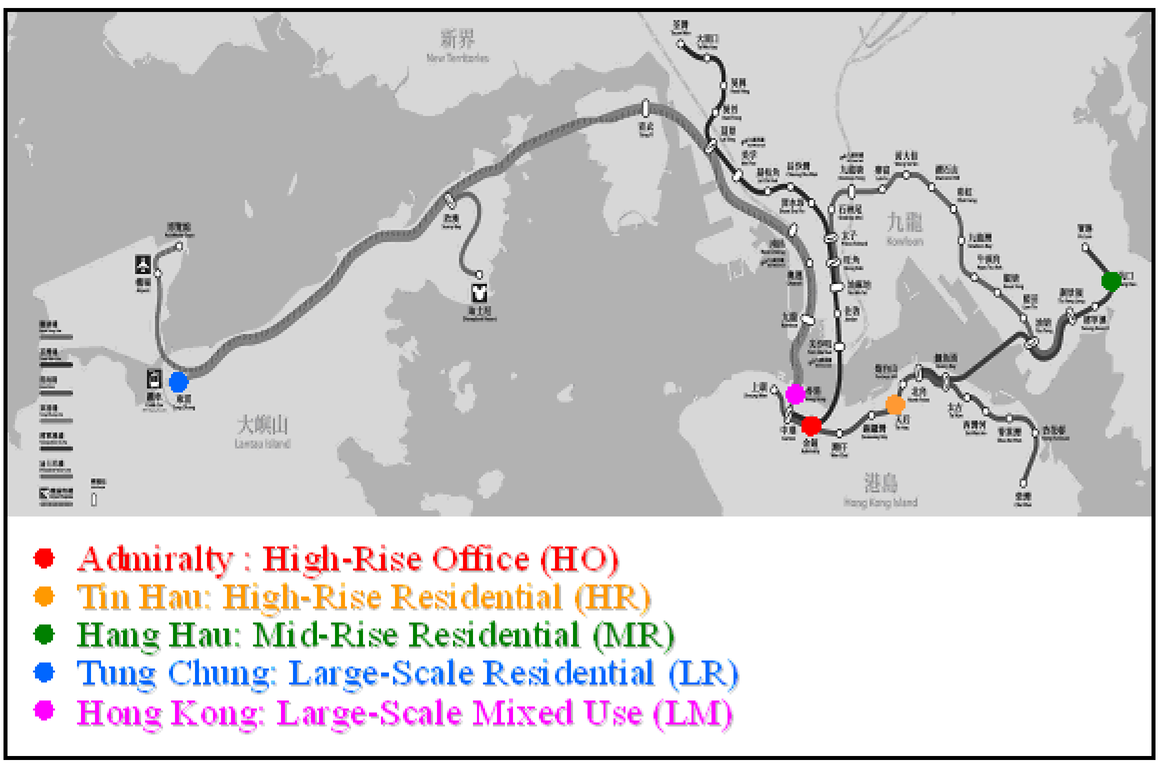


Figure 4.1. Case-Study MTR Stations with R+P Projects

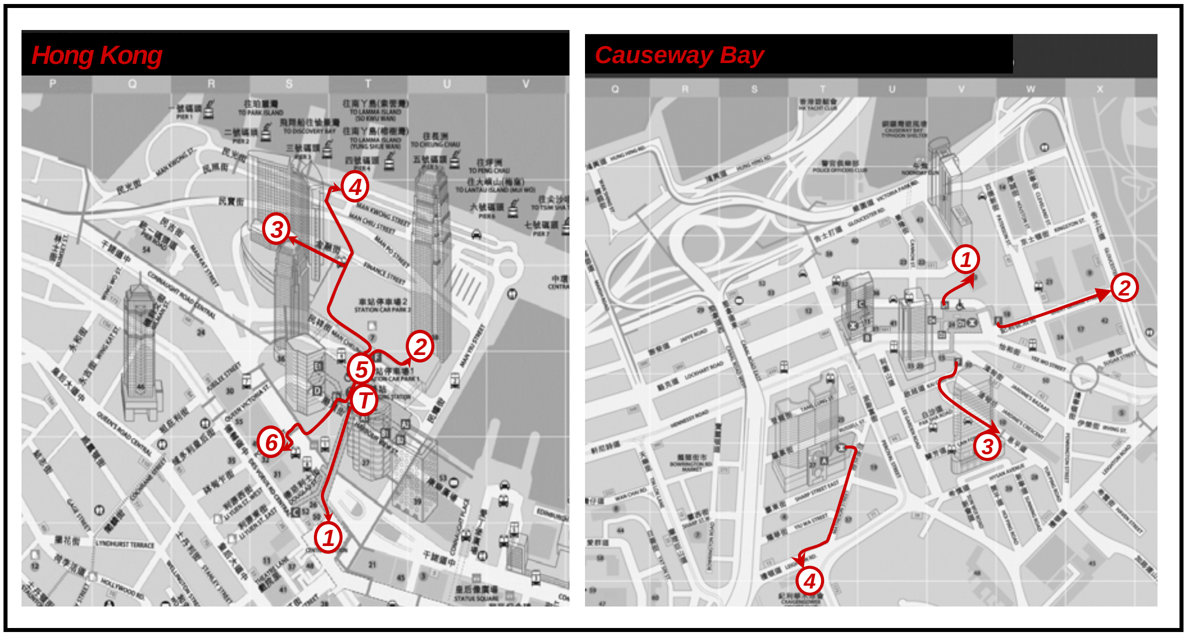


Figure 4.2. Examples of Selected Walking Corridors for Case-Study Field Surveys: Hong Kong and Causeway Bay Stations

4.2 R+P Cases

This section summarizes the case-study findings for each of the five R+P "built environment" prototypes: Admiralty (High-Rise Office -- HO); Tin Hau (High-Rise Residential – HR); Hang Hau (Mid-Rise Residential – MR); Tung Chung (Large-Scale Residential – LR); and Hong Kong (Large-Scale Mixed Use – LM). While not necessarily a fully representative sample of R+P projects, the case sites are nonetheless illustrative of the kinds of R+P developments MTRC has pursued over time.

Admiralty (HO)

The R+P project above MTR's Admiralty station occupies a 0.7 hectare site, featuring high-rise office towers with lower-level retail in an enclosed shopping mall configuration (Figure 4.3). It represents the "High-Rise Office" (HO) type of R+P project. Opened in 1980, Admiralty station lies in the midst of an active commercial district near the heart of downtown Hong Kong. Its mixed-use air-rights development is among MTRC's early-generation R+P projects.

The Admiralty Station receives high marks for physical integration (Photo 4.1). Vertically, the upper-level offices as well as the lower-level PTI (public transport

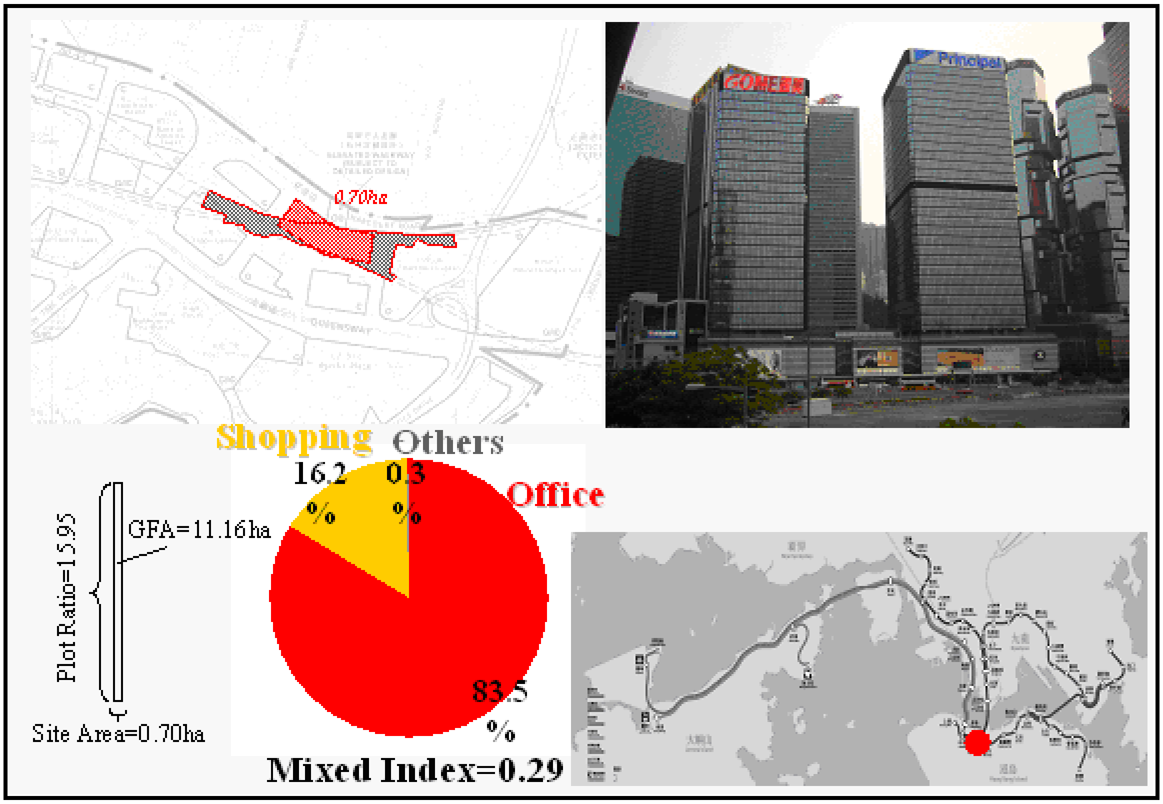


Figure 4.3. Admiralty Station R+P Project: Site, Built Environment Attributes, and Station Location

interchange) functions are directly tied to the station concourse via banks of elevators and escalators. Horizontally, well-lit entrances open onto surrounding streets and a network of grade-separated footbridges link to surrounding blocks, allowing pedestrians to avoid street-level traffic conflicts. The site also has ample pedestrian amenities including open space (Hartcourt Garden) and multiple vistas of the bay.

Tin Hau (HR)

The Tin Hau station's R+P project is mainly a high-rise residential tower on a fairly small site, producing a plot ratio above 14 (Figure 4.4). Completed in 1989, this project is of the "High-Rise Residential" (HR) R+P type and among MTRC's earliest portfolios of R+P projects. The surrounding neighborhood consists mainly of residential towers and an aging retail district.

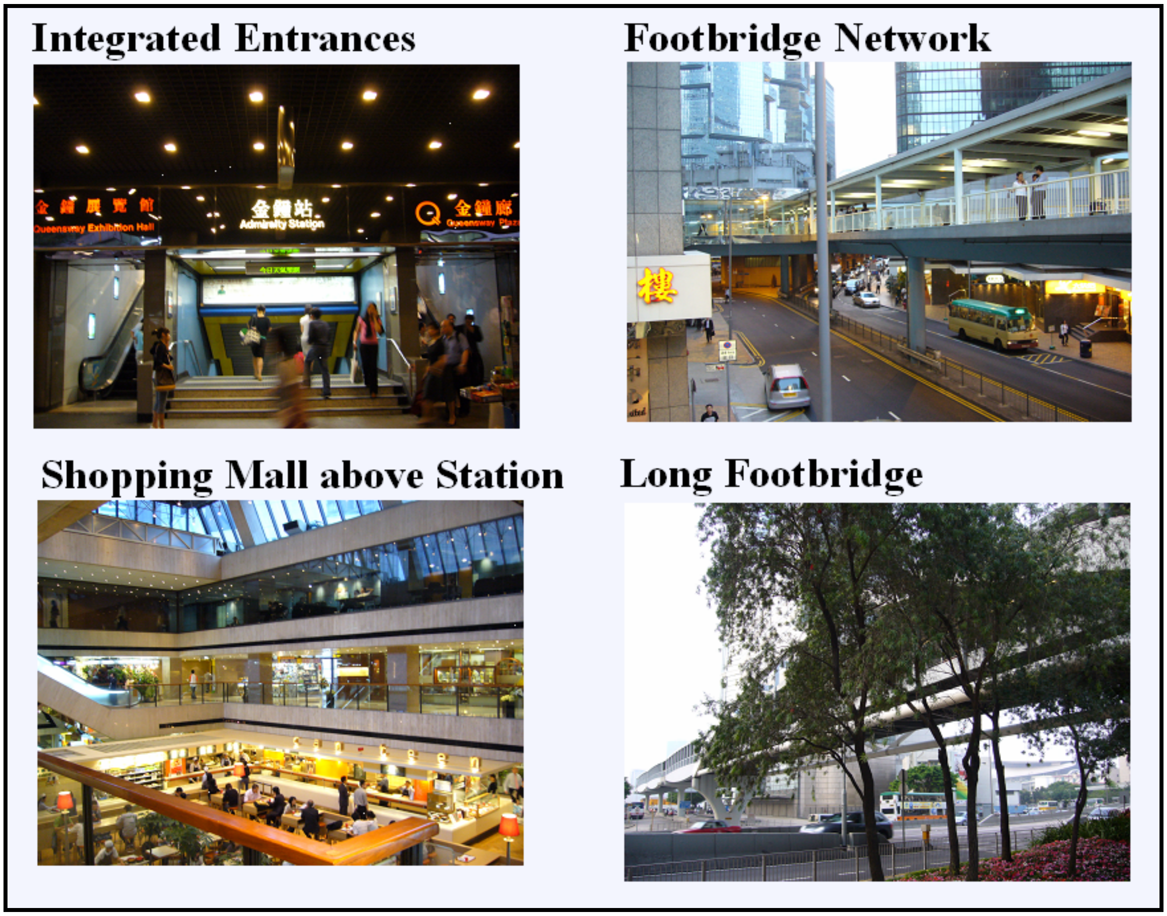


Photo 4.1. Admiralty Station: Vertical and Horizontal Integration

As revealed by Photo 4.2, the Tin Hau station is connected to surroundings via at-grade sidewalks. It has ample provisions for car parking and bus connections, although the somewhat imposing scale of these inter-modal facilities detracts from the pedestrian environment. A pocket park does abut the station, however, a nice amenity in light of the area's high densities. Overall, Tin Hau's R+P project was designed mainly with financial objectives in mind with the quality of pedestrian environment given modest attention.

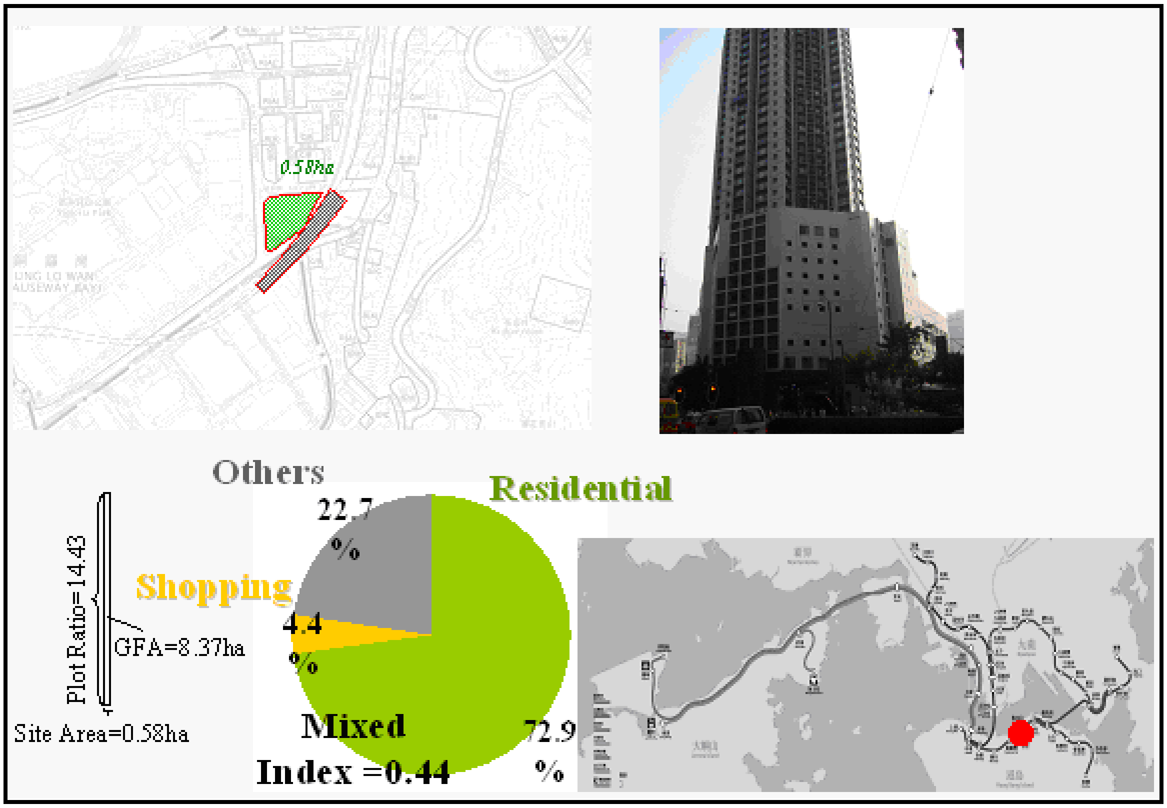


Figure 4.4. Tin Hau Station R+P Project: Site, Built Environment Attributes, and Station Location

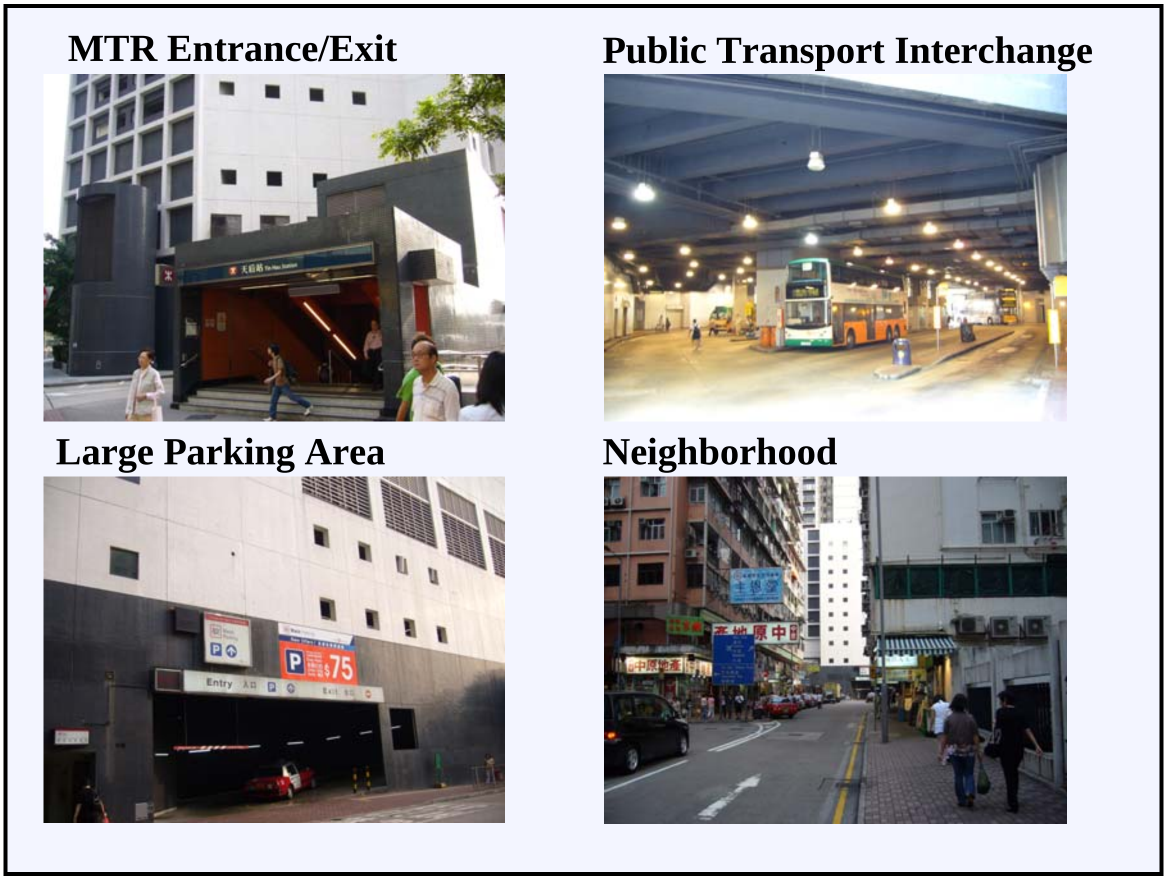


Photo 4.2. Tin Hau Station: Connectivity and Parking Provisions

<u>Hang Hau (MR)</u>

Completed and opened in 2005, the R+P project at the Hang Hau station marks a changing perspective among MTRC management about urban design and the relationship of R+P to surrounding communities. Notably, a strong emphasis is given to place-making and TOD, not unlike what one finds at suburban Scandinavian rail stations, as discussed in the previous chapter.

Hang Hau's R+P project is almost exclusively residential. With a moderate-size site and a plot ratio of nearly 8, it belongs to the "Mid-Rise Residential" (MR) R+P type (Figure 4.5). Some 200 meters beyond the station is public and subsidized housing built several decades ago.

As revealed by Photo 4.3, Hang Hau station's R+P project tends to the needs of residents, shoppers, and pedestrians quite well. The R+P project clearly distinguishes the private and public realms. Owner-occupied apartments are

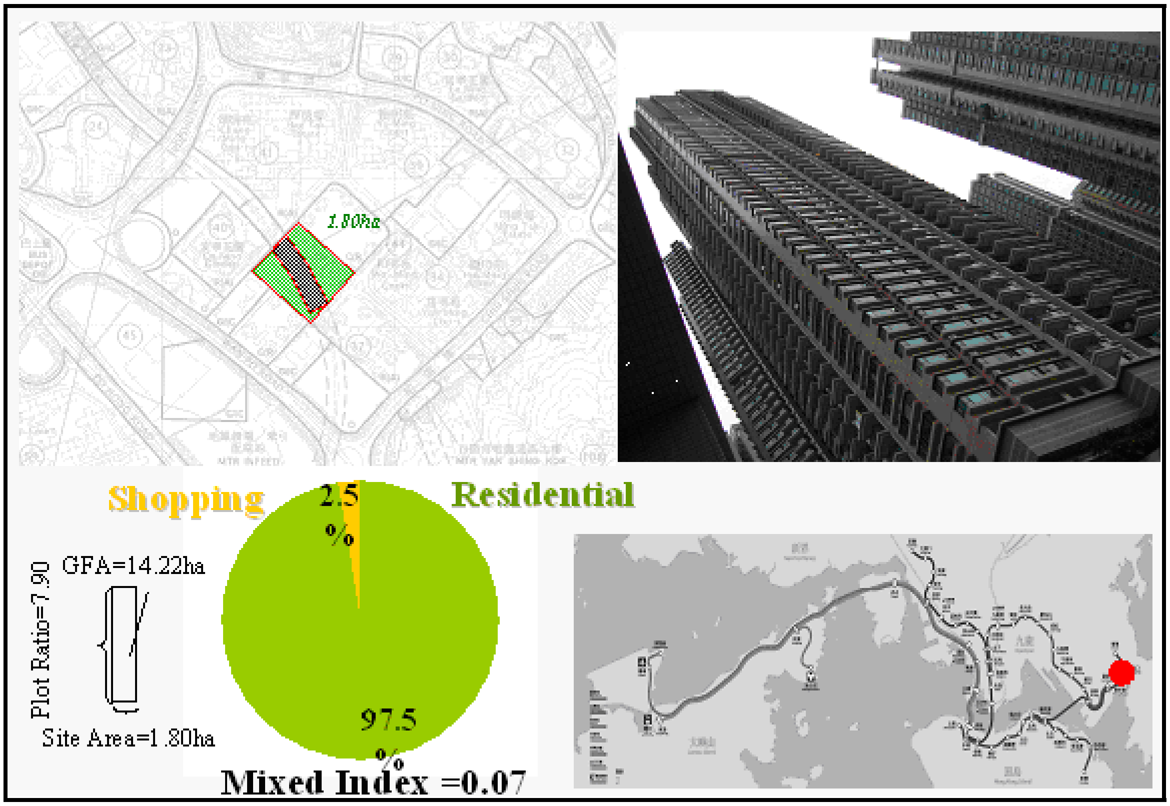


Figure 4.5. Hang Hau Station R+P Project: Site, Built Environment Attributes, and Station Location

directly tied to a nicely landscape garden and private club house that sits above the station. Residents also have direct elevator connections to the station concourse and lower level shopping mall. A phalanx of second-level footbridges links the shopping mall and station to the surrounding neighborhood. Overall, Hang Hau's R+P project has a comfortable, human-scale feel and a design that not only instills a sense of place but also protects the financial investments of tenants.

Photo 4.3. Hang Hau Station: Pedestrian Integration and Amenities

<u>Tung Chung (LR)</u>

Situated on MTR's airport extension line, the Tung Chung station's R+P project was built at a fundamentally different scale than most of its predecessors. Occupying a 21.7 hectare parcel, Tung Chung was conceptualized and built along the lines of a master-planned new town, comprising predominantly residential housing intermixed with retail shops, offices, and a hotel next to the station (Figure 4.6). Tung Chung was also designed with TOD principles in mind (Photo 4.4). Several hundred meters from the station lies an arc of 30-plus story residential towers, connected to the town center by a network of covered walkways and footbridges. Upon exiting the station, MTR patrons are greeted by a spacious, attractively landscaped civic square dotted with public art. Thus rather than being overwhelmed by shadow-casting high-rise towers, as found in the denser parts of Hong Kong, those leaving the station step into a nice open space that welcomes sunlight. The "feel" of walking in and around the Tung Chung station is qualitatively different than that found at older MTR stations.

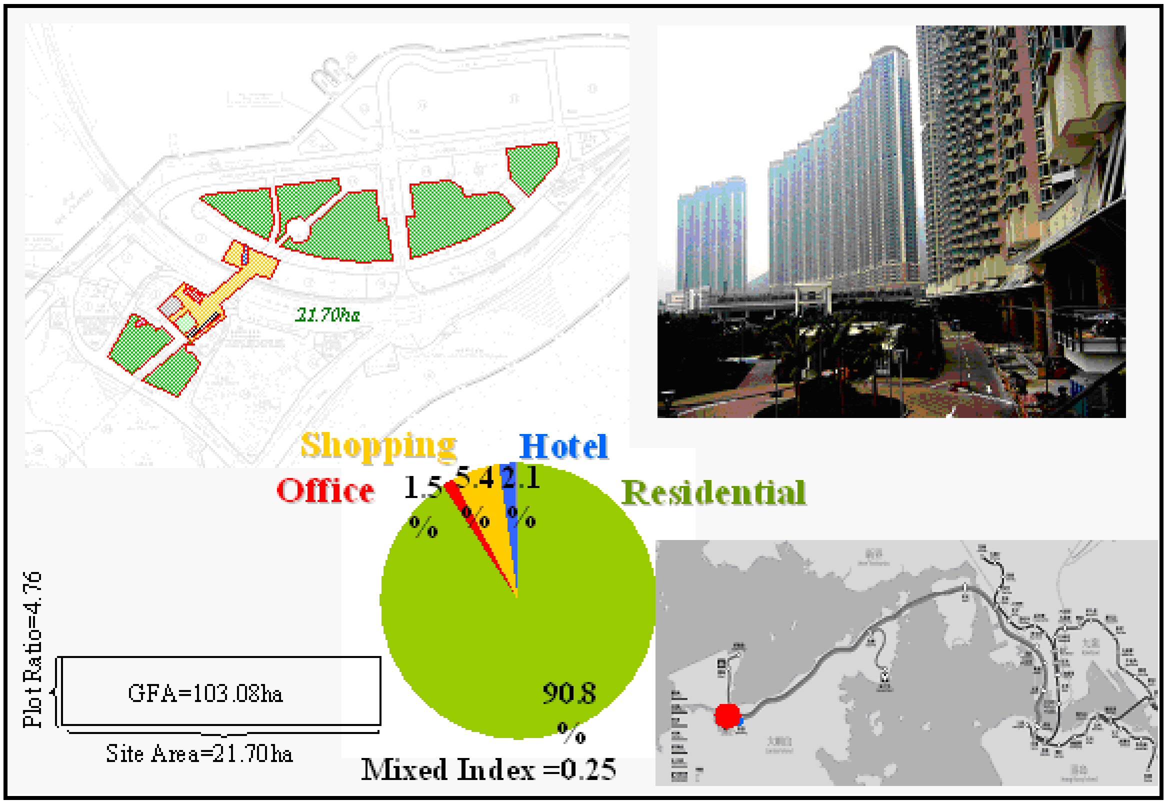


Figure 4.6. Tung Chung Station R+P Project: Site, Built Environment Attributes, and Station Location

With most housing five or more minutes from the station, the designers of Tung Chung's R+P project were particular sensitive to concerns over safety and security. The station concourse and adjoining mall are brightly lit at night. So is the network of protected pedestrian-ways that link to surrounding towers. Throughout the project, car traffic and pedestrian circulation are completely separated (Figure 4.7).

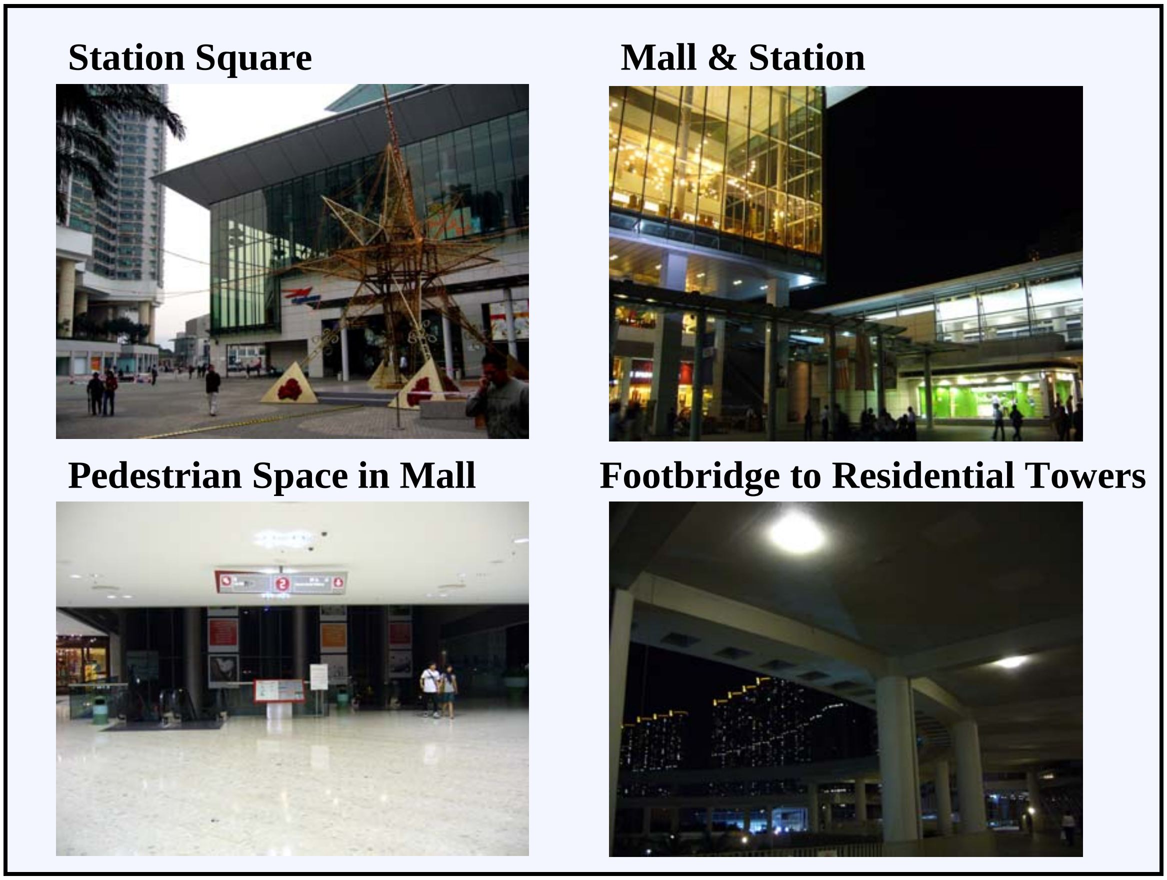


Photo 4.4. Tung Chung Station: Pedestrian Provisions and Amenities

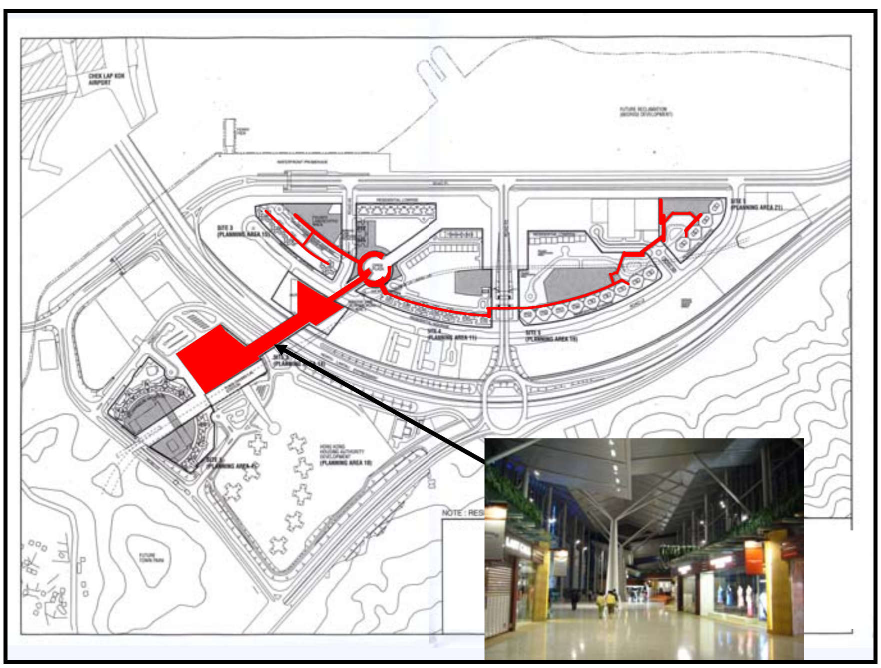


Figure 4.7. Second-Level Skybridge Network at Tung Chung Station

Hong Kong (LM)

Opened in 1998 as an inter-modal station and eastern terminus of the airport extension, the Hong Kong station and its air-rights development shows that TOD designs need not be limited to greenfields and suburbs. Situated in the heart of Hong Kong's bustling central business district, the mixed-use R+P project at Hong Kong station nets out at a moderate plot ratio of 7.3 owing to the 5.7 hectare parcel it sits on (Figure 4.8). Built as part of a city-led waterfront redevelopment initiative, the station and its environs have a surprisingly generous amount of greenery and open space (Photo 4.5).

The Hong Kong station is a veritable beehive of activity. Anchored by the towering International Financial Center (IFC), Hong Kong station is the international face of Hong Kong. A Four Seasons hotel also occupies the site. The station's subterranean and ground levels are functionally tied to the airport line, bus lines, the Star Ferry, taxis, and a Public Light minibus terminus. An airport check-in facility in the station allows passengers to hop on express trains and go directly to passport control. A cavernous underground pedestrian passageway with fast-moving horizontal escalators connects the Hong Kong and Central stations. At the second level the station connects to a modern shopping mall. Beyond the station site, a network of footbridges links surrounding offices and the harbor-front. Well-placed signage and digital screens conveniently direct pedestrians to destinations, enhancing the area's legibility. The strong accent placed on public art, open space, greenery, and civic areas contributes to the site's aestheticism and sense of place.

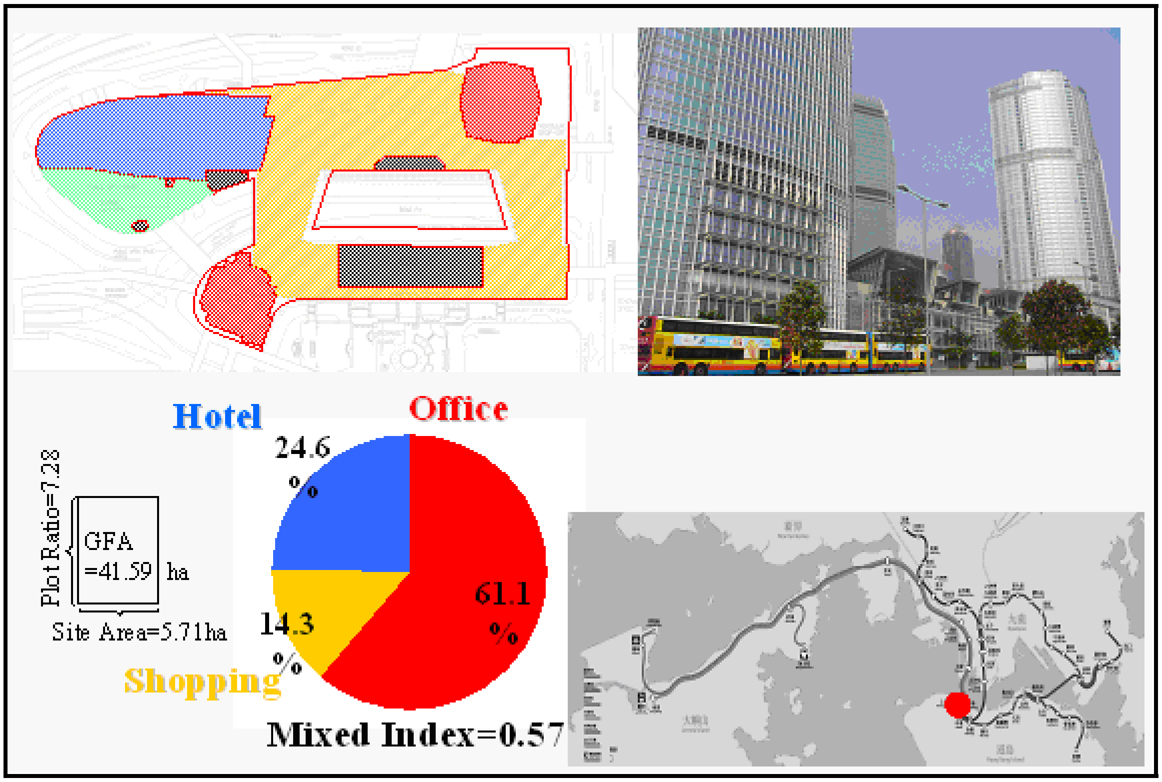


Figure 4.8. Hong Kong Station R+P Project: Site, Built Environment Attributes, and Station Location

4.3 Non-R+P Cases

As revealed by the field surveys and photographs in Appendix 3, the selected non-R+P cases are polar opposites of R+P stations with regards to physical integration, connectivity, and pedestrian amenities. This is especially the case in comparison to MTR's newer generation of R+P projects, such as Tung Chung and Hong Kong stations. As has been the case elsewhere in Hong Kong where growth pressures have overwhelmed the ability to comprehensively plan, the non-R+P sites give marginal attention to the needs of pedestrians and in some instances, inter-modal connections.

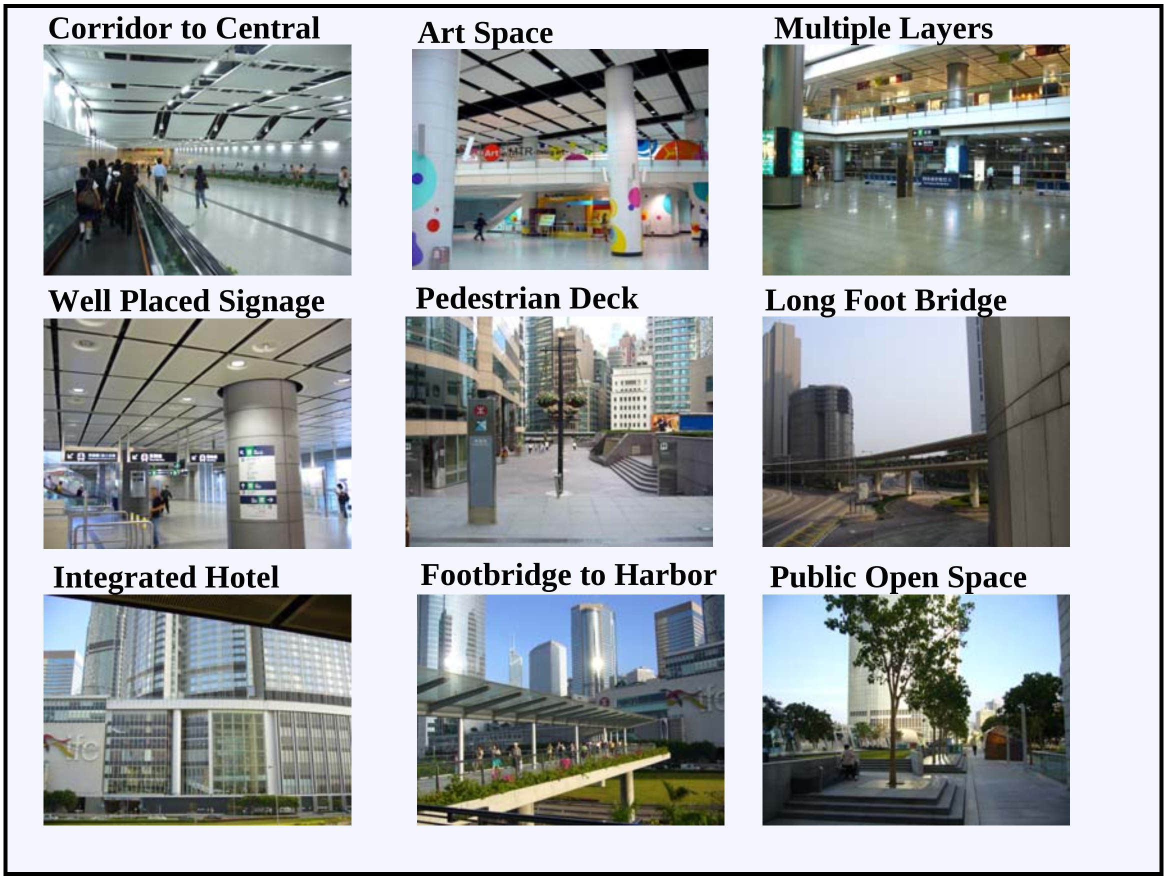


Photo 4.5. Hong Kong Station: Connectivity and Aesthetics

Non-R+P Stations

Narrow sidewalks amidst busy street traffic (Quarry Bay), stations bounded by busy highways (Ngua Tau Kok), and the lack of coordinated signage and legible walkway corridors (Causeway Bay) render the non-R+P cases far less "pedestrian friendly" than the R+P cases. The photographs and survey notes in Appendix 3 suggest that areas immediate to these stations evolved in an ad hoc, uncoordinated manner. Pedestrian amenities tend to be few and far between at these stations. Stations themselves hardly have the signature TOD feature of functioning as neighborhood hubs.

Non-MTR-Served Neighborhoods

The two case-study neighborhoods not served by MTR are also missing some of the key elements of well-designed R+P projects. One, East Sim Sha Tsui, lies in a dense, predominantly residential part of Kowloon, served by the former Kowloon-Canton Railway (KCR) (that merged with MTRC in December 2007). However the surrounding neighborhood pre-dates the railway station, which was sited based on land availability, not to leverage redevelopment. Thus, the neighborhood's spatial pattern is not station-based; it lacks a focal point and much in the way of pedestrian amenities.

The one case-study site with no railway services, South Horizons, relies on buses to connect residents to the center city. Suburban in character, the South Horizons neighborhood is laced by at-grade roadways and sidewalks. Pedestrian circulation is multi-directional, detracting from the area's sense of place.

4.4 Case-Study Summary: Lessons on Urban Design

As a supplement to the previous chapter's quantitative analysis for building typologies of R+P projects, the qualitative assessments presented in this chapter speak to the so-far missing "D" of the 5Ds -- Design. A comparison of the urban designs of stations with R+P projects versus other cases highlights the importance of TOD and "place-making" attributes discussed in Chapter Two: connectivity, comfortability, aestheticism, amenities, legibility, and natural surveillance. Below, key differences between R+P and non-R+P cases in regards to these and other elements – all of which bear on the needs of pedestrians --are summarized.

Horizontal Connectivity and Integration

All R+P projects are physically integrated with MTR stations (with the exception of the Tin Hau case) and surrounding buildings. Connections tend to be direct, safe, well-illuminated, and spacious. The non-R+P station cases (Quarry Bay, Ngau Tau Kok, and Causeway Bay) have noticeably poorer connectivity and fewer pedestrian amenities (Photo 4.6). Footbridges from nearby residential towers that abruptly stop short of rail stations were found in two instances.

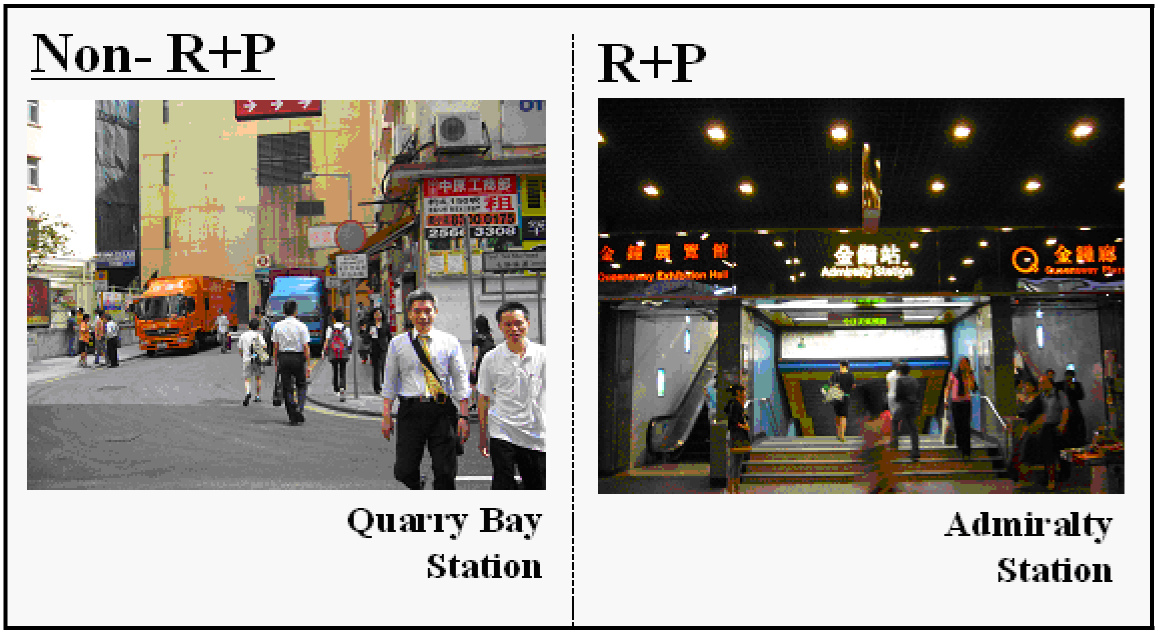


Photo 4.6. Contrasts in Physical Integration and Connectivity: Quarry Bay and Admiralty Stations

Vertical Connectivity and Integration

Most R+P stations do a good job of linking connecting "modes" of – both motorized and non-motorized -- traffic that operate a different levels. Typically ground floors and below are devoted to motorized transport – car parking and buses. Above-ground levels are mostly for pedestrians and retail functions. Thus movement conflicts are avoided and accidents reduced, courtesy of grade-separation. Station access/egress by car and bus is more efficient and convenient; walking to and from stations is safer and more direct. In contrast, pedestrians and cars tend to co-mingle in the non-R+P cases, creating less secure and more chaotic walking environments (Photo 4.7).

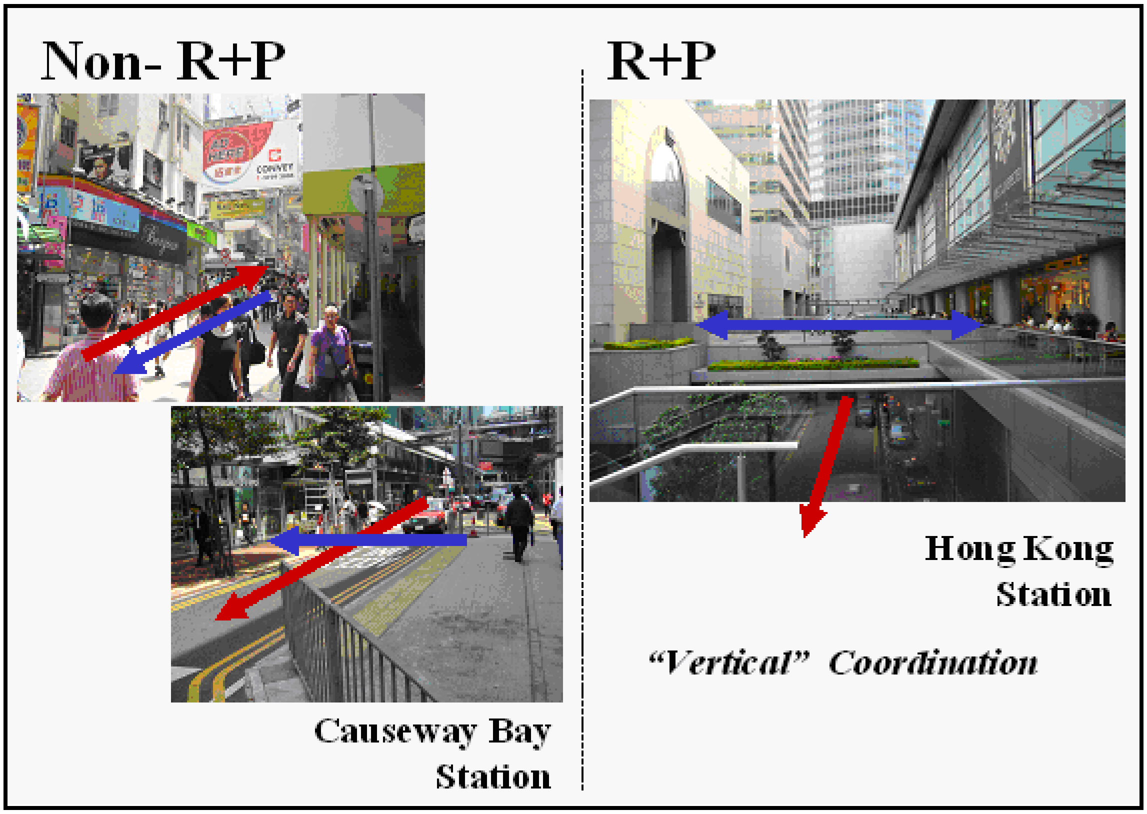


Photo 4.7. Contrasts in Physical Integration and Connectivity: Causeway Bay and Hong Kong Stations

Blending Retail and Pedestrian Corridors

Most R+P projects strategically link pedestrian corridors and in-station retail activities. This creates synergies by enabling rail patrons to take care of personal needs while also generating retail sales revenues. In some instances, shops generate new public-transit trips by functioning as rail-served destinations. Typically, convenience retail built as part of R+P projects is placed near station entrances or along sheltered walkways (e.g., Hang Hau and Tung Chung). This not only avoids the cluttering of retail and rail-related functions within stations, but also allows one-stop shopping in temperature-controlled settings, which is particularly valued when it is hot and humid. Tung Chung’s 24-hour station-area retail and brightly lit footbridge network also instills a sense of security. Among the non-R+P stations studied, blank passageways and minimal retail provisions create a totally different walking experience – less convenient, less attractive, less memorable (Photo 4.8). Reliance on stairwells in lieu of escalators, such as at the Ngua Tau Kok station, also makes changing levels difficult for the elderly and those with physical disabilities.

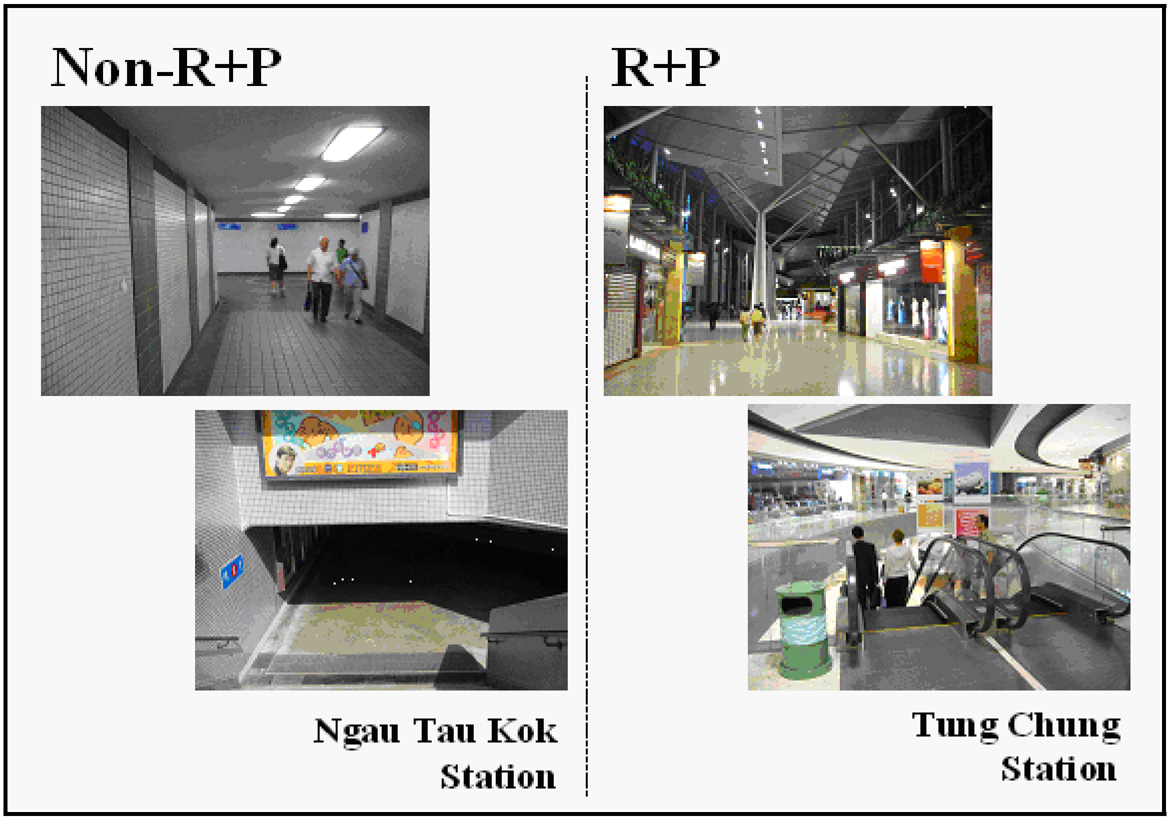


Photo 4.8. Contrasts in Pedestrian-Retail Blending: Ngau Tau Kok and Tung Chung Stations

<u>Amenities and Openness</u>

Most R+P stations win high marks for creating attractive public spaces that both rail commuters rushing to their destinations and those taking a casual stroll can enjoy. In addition to the presence of amenities like public art and street furniture, many R+P station areas also have ample open space by Hong Kong standards -- in the form of pocket parks (e.g., Admiralty and Tin Hau), public squares (e.g., Hang Hau and Tung Chung), public parks (e.g., Tin Hau and Hong Kong), and green corridors (e.g., Hong Kong and Tung Chung). The provision of airy open space is all the more appreciated given the high-rise profile surrounding stations like Hong Kong and Admiralty. Because of their suburban locations, some non-R+P cases also have open space, although there are generally fewer pedestrian amenities in these settings (Photo 4.9).

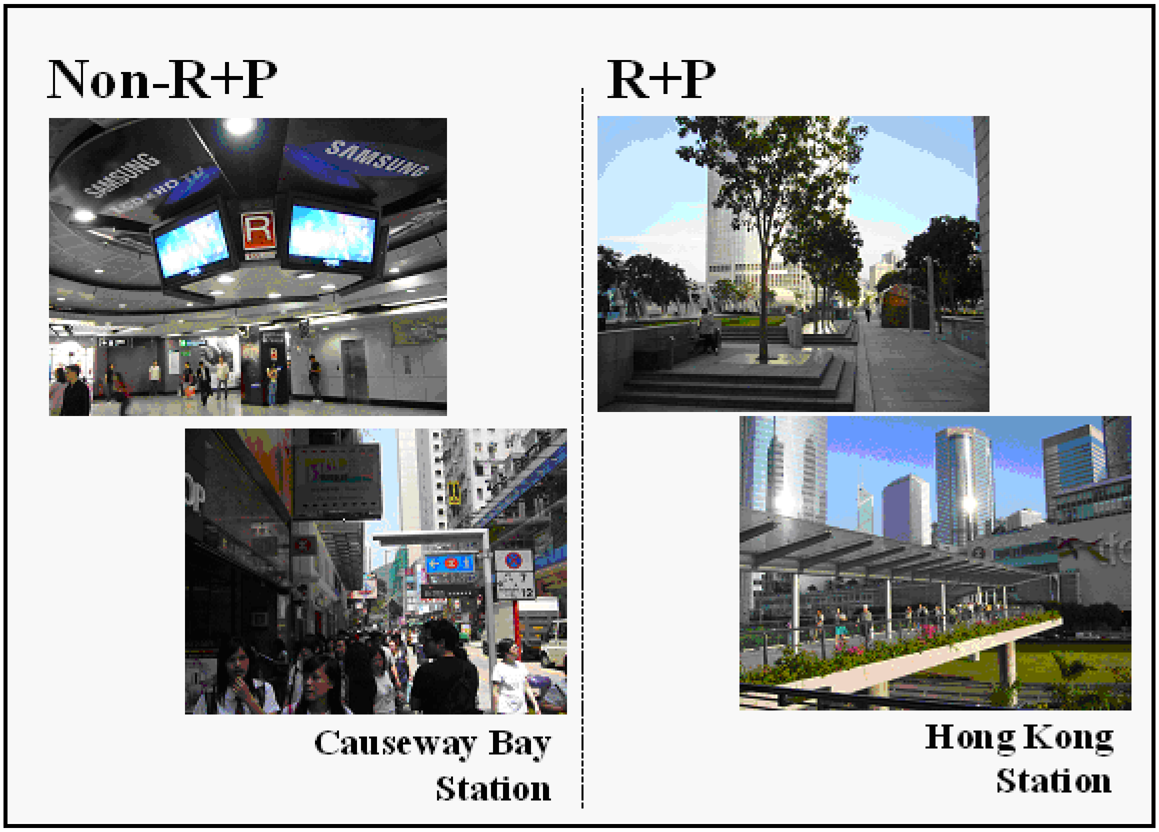


Photo 4.9. Contrasts in Pedestrian Amenities and Open Space: Causeway Bay and Hong Kong Stations

Legibility and Focus

R+P stations are generally easy to "read", both in and outside of stations. Clear and direct sight lines, good signage, and footbridge provisions offer assurances that pedestrians are on the right paths to their destinations. Moreover, R+P stations like Hang Hau, Tung Chung, and Hong Kong function as hubs of the immediate neighborhood and provide a focal point for future development. Some of the non-R+P stations, by contrast, are far less legible, reflected by either too little or too confusing signage, disrupted walking corridors, and a fairly benign presence in the neighborhood (e.g., Quarry Bay and Causeway Bay) (Photo 4.10).

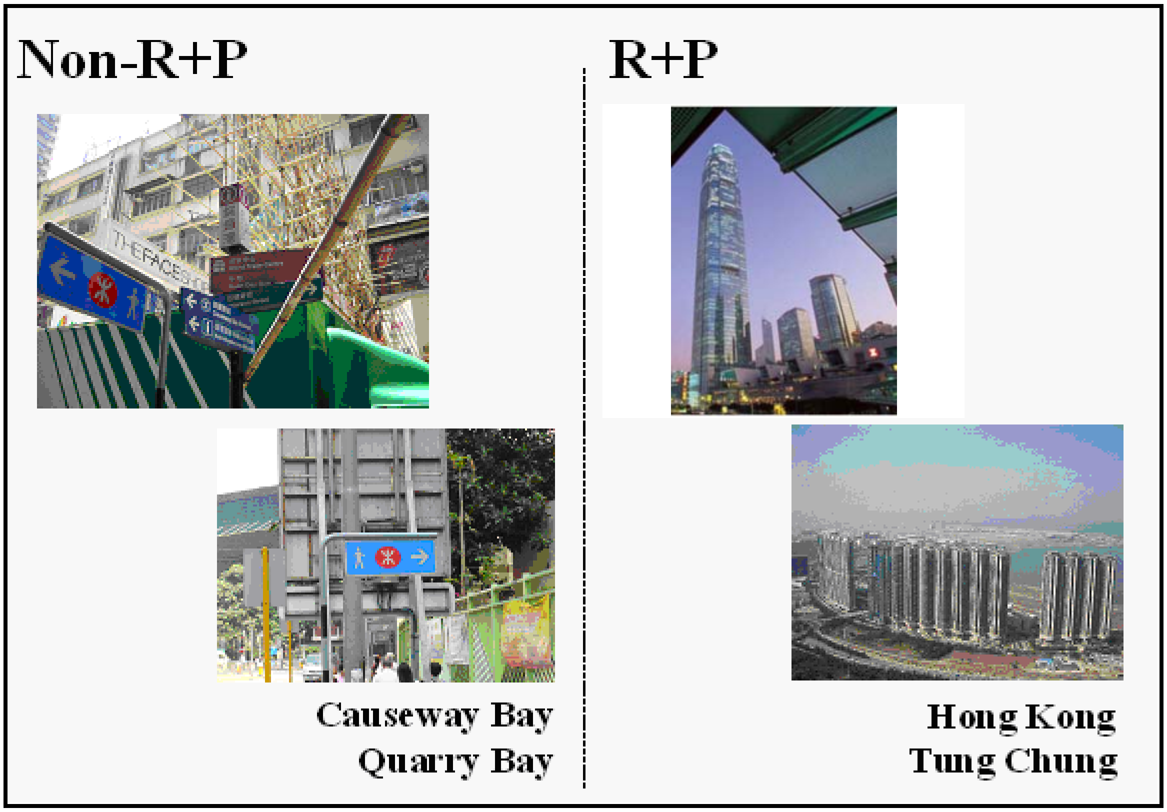


Photo 4.10. Contrasts in Legibility and Community Focus: Causeway Bay and Quarry Bay; Hong Kong and Tung Chung

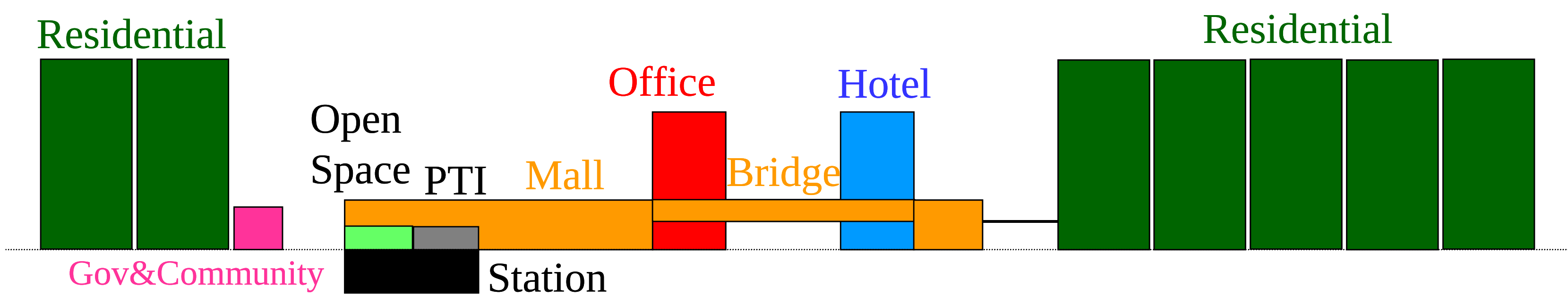
4.5 Insights into R+P Partnership Arrangements

Institutionally, all R+P projects involve public-private partnerships. As such, they are potential "win-win" situations for all parties involved. As noted earlier, the conduct of field surveys of R+P projects provided insights into how the roles and functions of different stakeholders were sorted out in the development process – specifically with regards to project construction, management, cost- and profit-sharing, and asset ownership. Mapping this according to specific land uses further revealed how various public and private sector roles were spatially distributed.

Figure 4.9 summarizes the arrangement that evolved for the Tung Chung R+P project. The figure also illustrates the positioning of land uses with reference to the station. In the case of Tung Chung's R+P package, the developer constructed the project in consultation with MTRC. Enabling works, like site preparation and public infrastructure, were overseen by MTRC through multiple concessions. Financially, the project moved forward by the developer paying both the land premium and all development costs. Through negotiations with MTRC, returns on investment were shared for both upfront (e.g., payment at tender award) and downstream (e.g., property sales) profits.

Figure 4.9 further reveals the ownership and management responsibilities for specific land uses. Residential units are owned by individuals however the complexes themselves are managed by MTRC. As noted in Chapter One, this arrangement ensures, both for tenants and MTRC, high-quality operation and maintenance of residential towers. Private, non-residential activities are owned and managed by the developer, except for the site's lodging which is managed by the hotel operator. The developer also has responsibility for managing the town square while public entities are charged with overseeing government and community facilities, including public transport interchanges.

Appendix 4 provides similar diagrams for the other four R+P case study sites: Admiralty, Hang Hau, Tin Hau, and Hong Kong stations. Partnership arrangements vary in each case though for the most part, patterns are more similar than different – e.g., developer construction and upfront payment of development rights; private ownership but MTRC management of housing; and government oversight of the public realm.



	Residential Towers	Mall + Retail Bridge	Office	Hotel	Town Square	GIC (Post Office and Day Nursery)	Public Transport Interchange
1. Construction	Developer based on railway/development coordinated design; enabling works provided by MTRC (multiple packages)						
2. Mechanism for sharing costs & profit	- Developer paid land premium and development cost - Investment return split by up-front profit and end-profit sharing				Part of the property design	Conditions in land grant	
3. Ownership of Asset	Individual flat owners	Developer			Common area of the mall and PTI	Government	
4. Management	MTRC	Developer		Hotel operator	Developer	Government delegated to operator	

Figure 4.9. Partnership Arrangements for developing various components of the Tung Chung R+P Project

Chapter Five
Corridor Analysis of R+P Projects

5.1 Growth and Travel Along MTR's New Rail Lines

The previous two chapters used the R+P typology to examine differences in built environments among projects. The case studies of urban design, moreover, suggested newer R+P projects have embraced TOD principles more so than their predecessors. That is, the designs and built environments of R+P projects appear to vary as much by age as by typology. For this reason, this chapter complements the previous one by comparing built environments by three groupings: (1) early lines -- the 17 R+P projects built on MTR's original network during the 1979-1985 period; (2) Tseung Kwan O (TKO) Line – 3 R+P projects built in conjunction with urban redevelopment since the line's 2002 opening; and (3) Tung Chung Line – 5 R+P projects built since the line's 1998 opening in concert with both central-city redevelopment and suburban new-town development on Lantau Island. The key distinction, we believe, lies between R+P projects from two or more decades ago versus recent-generation projects built in tandem with new lines and extensions. Given differences in urban character, we suspect there are also subtle differences in R+P projects between the two recent lines: TKO versus Tung Chung. This chapter closes by comparing ridership growth and travel patterns among station groupings.

MTR's new rail extensions have been sited in some of the fastest growing areas of Hong Kong territory. Figure 5.1 shows that between 2001 and 2006, population within the territory as a whole grew by slightly less than one percent. In the Sai Kung sub-district in Hong Kong's eastern reaches, the area served by the new TKO line, population grew by 22.7% during this period. To the west, the districts served by the new Tung Chung line grew at contrasting rates: 6.7% for the fairly built-up Kwai Tsing sub-district versus 53% for outlying Lantau Island. The baseline value for Lantau Island, of course, was relatively low, thus in aggregate terms, the other sub-districts witnessed large population increases. Still, the rate of growth on Lantau Island is impressive for a six-year period. Whether the MTR rail lines spurred or responded to this growth is a subject of debate. Most likely, a bit of both occurred.

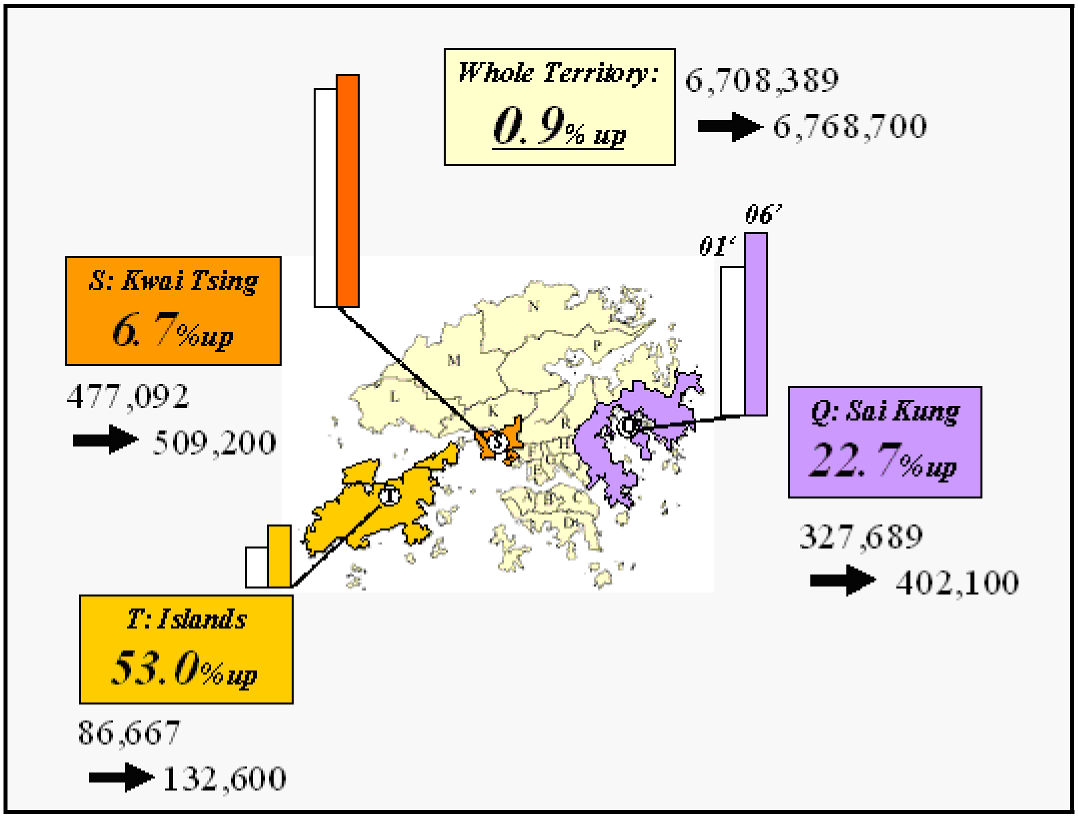


Figure 5.1. Comparison of Population Growth Rates Among Sub-districts of Hong Kong Territory: 2001-2006

With numerous islands, isthmuses, coastal indentations, and mountains, Hong Kong's landscape creates many natural bottlenecks. For those traveling by cars, buses, and trucks, this often translates into extreme peak-period traffic congestion. From a transit agency perspective, however, Hong Kong's natural corridors invite high ridership. For the corridors served by the two new lines, rail-transit's crucial mobility role is underscored by Figure 5.2. The bridge to Lantau Island along the Tung Chung corridor carried around 51,000 vehicles per day in 2006; along this stretch, MTR carried around 75,000 passengers each day. The differential was far greater along the TKO corridor: 64,000 daily vehicles on the bridge versus 301,000 daily MTR passengers. Clearly, if rail services did not exist and passengers instead had to take buses, congestion would be far worse at these chokepoints. MTR's critical mobility role is further highlighted by the modal split statistics in Figure 5.2. From a telephone survey conducted by MTRC in 2005, 37% and 54% of residents living near Tsing Yi and Tung Chung stations respectively said they typically took MTR one or more times per day. Among those surveyed along the TKO corridor, the share was 63%. This contrasts with a 29% modal split for surveyed residents living near at all other MTR stations.

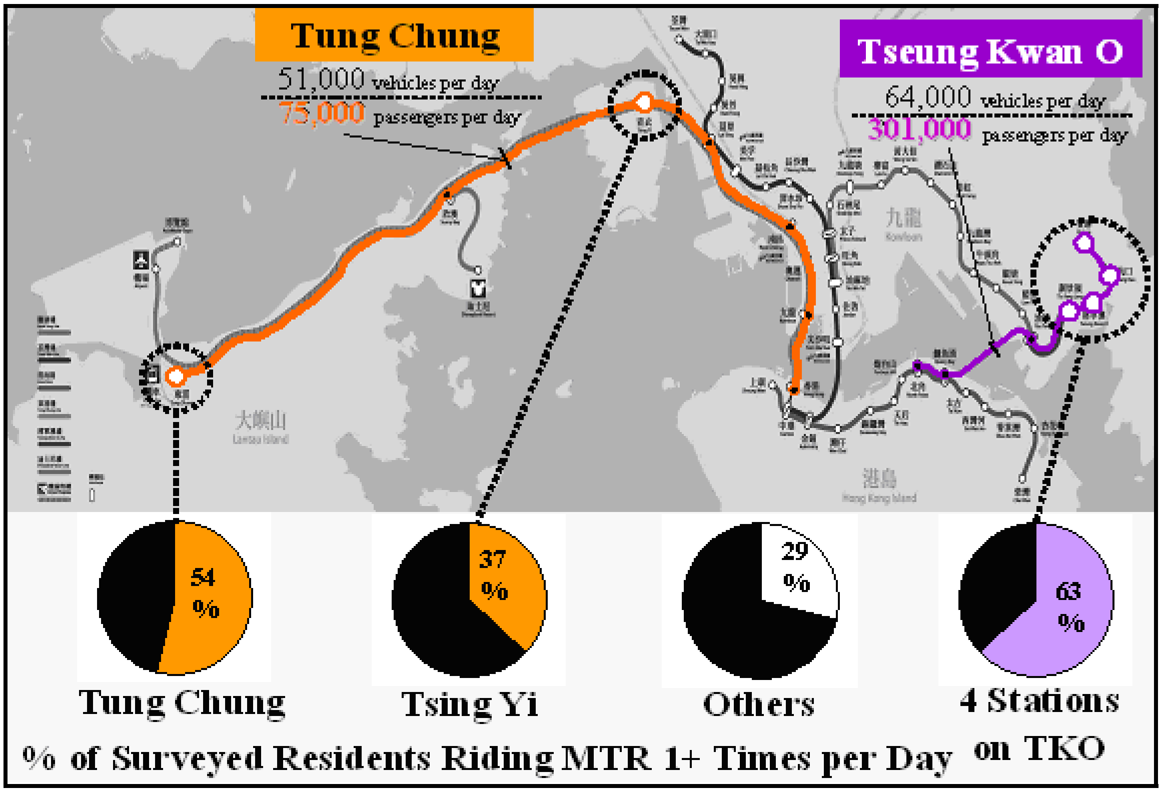


Figure 5.2. Vehicle and Rail Passenger Counts at Bridges and Rail Modal Splits Along New MTR

5.2 Corridor Comparisons of R+P Built Environments

MTR's Tung Chung line runs from Hong Kong's dense core to the greenfields of Lantau Island, terminating at the Tung Chung new town. MTRC's five R+P projects along this stretch are similarly varied, as shown in Figure 5.3. Located in built-up areas, R+P projects at the Kowloon and Hong Kong stations are dense and showcase multiple uses. As one goes farther out from Hong Kong station, densities decline and housing becomes more dominant.

For the TKO line, the R+P project at the Tseung Kwan O station differs from the other two (Figure 5.4). All R+P projects on this corridor are on reclaimed land, however the project at the Tseung Kwan O station is notable for its wider variety of land uses and lower net density. From an urban design standpoint, the R+P project at Tseung Kwan O station also has more of a TOD character.

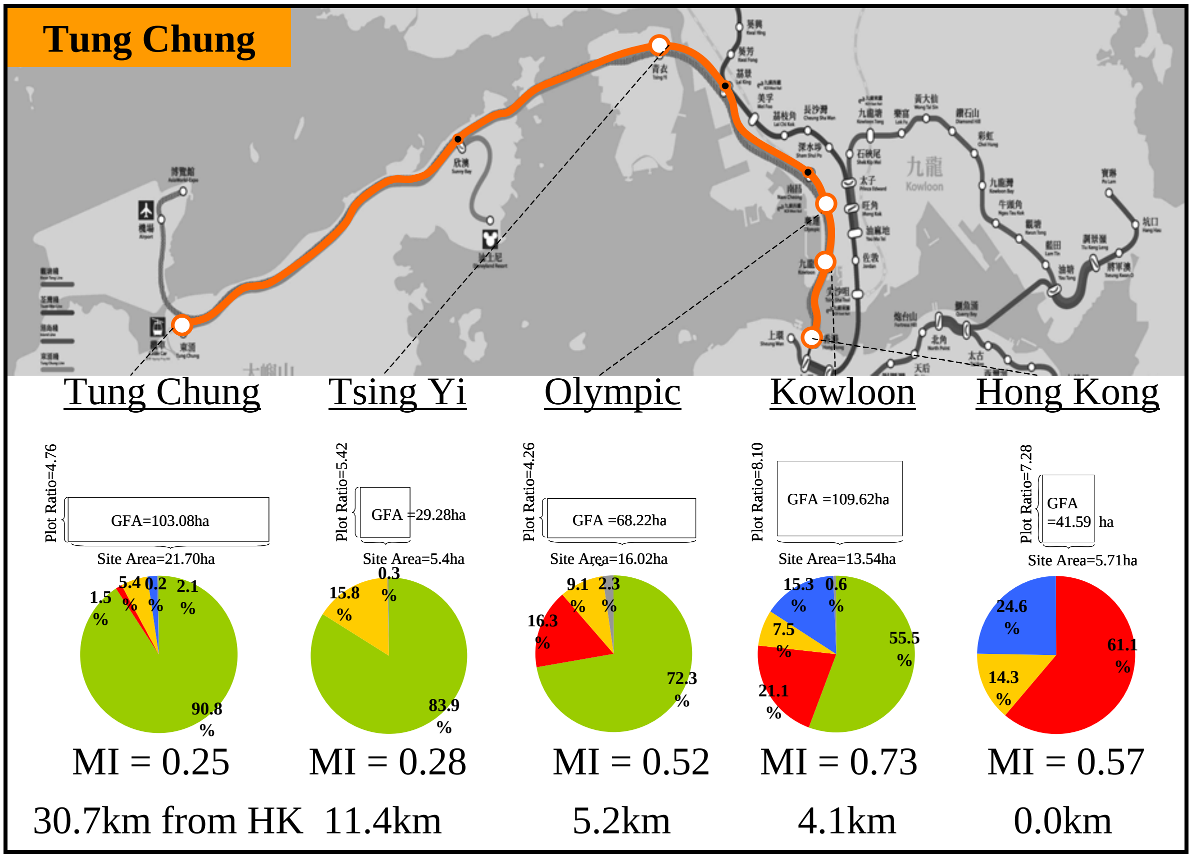


Figure 5.3. Tung Chung Corridor: Built Environment Characteristics of the Line's 5 R+P Projects.

Note: MI = Mixed Use Index; Land use color codes for pie charts: red = office, yellow = retail, green = residential, blue = hotel, gray = other.

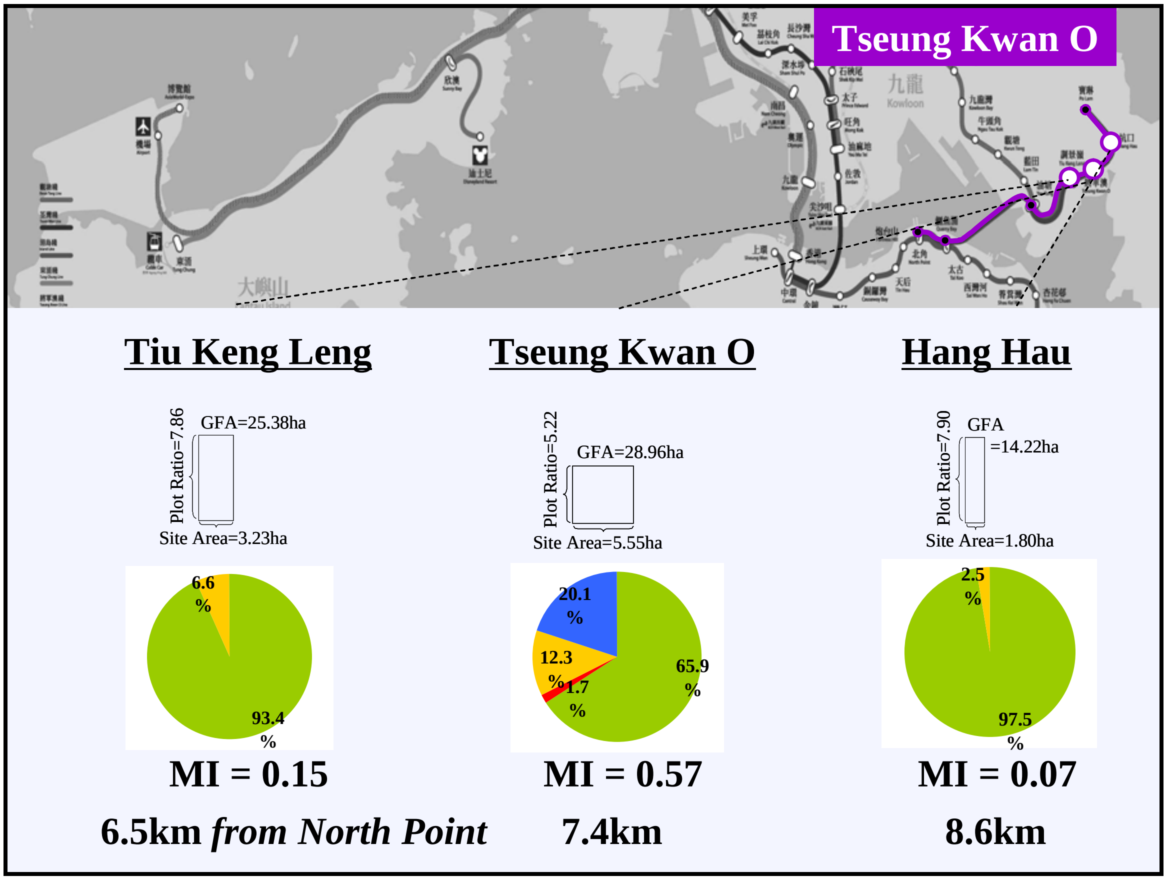
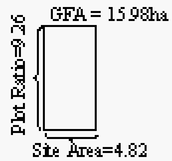
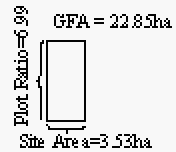
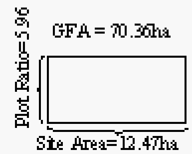
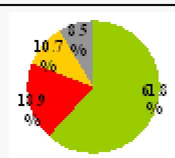
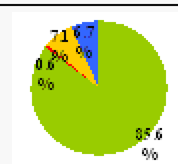
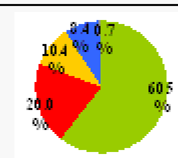


Figure 5.4. Tseung Kwan O Corridor: Built Environment Characteristics of the Line's 5 R+P Projects.

Note: MI = Mixed Use Index; Land use color codes for pie charts: red = office, yellow = retail, green = residential, blue = hotel, gray = other.

A comparison of statistics on three of the "Ds" – Density, Diversity, and Distance – reveals differences in R+P development not only between the two new MTR lines but more notably in comparison to R+P projects built along MTR's original lines. Table 5.1 shows that recent-generation R+P projects tend to be less dense and correspondingly more suburban in character. Station spacing along newer rail corridors also tends to be longer. Additionally, older R+P projects tended to concentrate larger numbers of housing units within 500m of stations. R+P projects on the TKO Line stand out in two respects: a focus on residential development and larger shares of housing units that are public or subsidized.

Table 5.1. Comparison of Averages in Density, Diversity, and Distance Attributes of R+P Projects Among Three Groupings: Early Lines, Tseung Kwan O Line, and Tung Chung Line

	Early Lines	Tseung Kwan O Line	Tung Chung Line
# of R+P Stations	17	3	5
Year(s) Opened	1979-1985	2002	1998
Density -Site Area -GFA -Plot Ratio			
-Average Station Distance	0.96km	1.23km	4.13km
-HUs within 500m	20,835	15,356	7,566
-HUs Private Share in 01'	67.3%	7.0%	69.1%
Diversity -Land Use -Mixed Index	 Mixed Index = 0.33	 Mixed Index = 0.27	 Mixed Index = 0.47
Distance -Travel Time to Central	15 minutes (2-27 minutes)	24 minutes (22-26 minutes)	18 minutes (8-35 minutes)

5.3 Ridership Patterns

Chapter Three explored whether ridership patterns varied among the five types of R+P projects. No strong relationships were found. Might there be patterns when examined across the corridor-level grouping of R+P projects?

While ridership has been fairly stable on MTR's older lines, it has steadily trended upwards on the newer ones. In the case of the Tung Chung line, daily patronage jumped 40% between 2001 (three years after its opening) and 2005. The TKO line did not even exist in 2001 but today carries well over a half million daily passengers. The TKO line, however, has less balance in peak-period directional flows than either MTR's original lines or the Tung Chung line, owing to the dominance of residential development around its stations.[1] As noted before, many residents along the TKO corridor rely heavily on rail services – nearly two-thirds of those surveyed indicated they take MTR at least once a day. Given the large shares that live in public or subsidized housing, this higher ridership is likely due more to transit captivity than any aspect of the built environment.

This brief discussion of station-area ridership among corridors segues nicely to the next chapter. Chapter Six specifically examines the influences of R+P, and notably projects built according to TOD principles, on ridership in addition to housing prices.

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[1] The mean "In & Out Balance" indices computed among R+P stations for the P.M. Peak were: 0.75 for early MTR lines; 0.64 for the TKO line; and 0.76 for the Tung Chung line. As discussed in Chapter Three, the *In & Out Balance Index* = $1 - \frac{|In - Out|}{In + Out}$ where *In* equals station entries and *Out* equals station exits. The index ranges from 0 to 1, with 0 indicating maximum skewness (i.e., only entries or exits) and 1 denoting maximum balance (comparable counts of entries and exits).

Chapter Six

R+P and TOD: Influences on Ridership and Housing Prices

6.1 Analytical Challenges

If R+P projects yield benefits, they should be reflected by gains in both ridership and real-estate prices. Because of high-quality designs, good inter-modal connectivity, and efficient on- and off-site circulation, one would expect a "bump" in ridership at R+P stations relative to others. Ridership gains are primarily *public benefits* to the degree they reduce traffic congestion, air pollution, and energy consumption. And as long as R+P projects are desirable places to live, work, and run a business, property prices will rise as people and institutions compete for limited supplies of floorspace. Rent premiums reflect *private benefits* owing to the demand for high-quality development and accessible locations in a dense urban setting like Hong Kong.

This chapter examines the association between R+P and ridership as well as housing prices. Multiple regression equations are estimated to gauge the marginal contributions of R+P on these outcomes holding the influences of other explanatory factors constant. As discussed in the previous chapters, R+P projects vary considerably in their designs and land-use compositions. Those built according to TOD principles are generally better quality projects. Thus the analyses that follow also distinguish whether R+P projects are "transit oriented" in predicting ridership and housing prices.

Methodologically, the challenge in gauging the pay-off of R+P by itself and "R+P as TOD" is *attribution* – how much of the variation in ridership and property values is due to project design versus all other (potentially confounding) factors. It is, of course, virtually impossible to prove R+P and/or TOD "caused" ridership or housing prices to rise in the sense of ruling out all other possible explainers. The best one can do is to bring in as many other explanatory variables as possible that, as suggested by theory, influence ridership and prices. The effort is complicated by the fact that defining what constitutes "TOD" is inherently subjective. In our case, we relied on qualitative case studies, presented in the prior chapter, to examine MTRC's experiences with TOD. Accordingly, we used qualitative (0-1 coded) "dummy" variables to designate whether a station was "TOD" or not. This is an imperfect way to capture desirable attributes like building integration, efficient circulation, and public amenities, however given data limitations, there was little choice but to use dummy variables. Regardless, we feel the findings that follow should be weighed less in terms of the magnitude of impacts and more with regard to direction – i.e., are the signs on the "R+P" and "TOD" dummy variables positive? The analyses are more exploratory than definitive and hopefully will spur follow-up work that takes advantage of new and improved data as MTRC's R+P program continues to mature.

6.2 R+P, TOD, and Ridership

In order to study the influences of R+P and TOD designs on ridership, a database was constructed using each of MTR's 51 stations as an observation. The use of station observations and multiple regression to predict ridership as a function of station-area and regional attributes has been called "direct ridership" modeling (Cervero, 2006). Besides many of the built-environment variables presented in Chapter Three (e.g., GFA by land use and residential densities), data were compiled on operational variables thought to influence ridership, like number of feeder bus lines connecting to a station and catchment size (based on average rail distance to the nearest two stations).[1] Ridership data were compiled for 2005. While most other variables were also as of 2005, variables like residential densities (e.g., households within 500 meters of stations) came from Hong Kong's 2001 census.

The analysis proceeded as follows. First, a "base" model is used to predict average daily ridership – both for five-day weekdays and two-day weekends – as a function of station-area, bus and rail connectivity, and location attributes.[2] Next, an "R+P" model is presented that supplements the base models with a

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[1] While service quality variables normally are included in direct models to predict ridership, in the case of MTR, train headways are comparably short across most stations, thus this variable was omitted from the analysis.

[2] The modeling was influenced by earlier work on the effects of station-area development on MTR ridership by Tang et al. (2004). Their study concluded that land-use characteristics associated with high MTR patronage were: (1) dense urban centers in the oldest districts of Kowloon and Hong Kong island; (2) major inter-modal transfer stations (including connections between MTR and KCR); (3) an orientation toward office employment; and (4) compact, mixed-use settings with vibrant street life. In contrast, low ridership stations tended to be farther from the core, had a single dominant land use, and exhibited relatively low densities.

dummy variable denoting whether a station observation has an R+P project or not.   To get at the influence of urban design, a "TOD" model is next presented that further distinguishes whether the R+P project embodies transit-oriented designs (most notably, mixed uses and high-quality pedestrian environments). This is followed by two further model refinements: one that distinguishes R+P stations with TOD designs by type (e.g., mid-rise residential, large-scale mixed use) and one that examines whether there are interactive effects between TOD and residential density – i.e., does the combination of high-rise housing development and TOD produce proportionately an even greater bump in patronage? In all of these cases, our aim is to examine whether bringing in the dummy variables or making model refinements adds marginal explanatory power, holding variables in the base model constant.

Base Ridership Model

The base model, presented in Table 6.1, shows that in 2005, MTR's average daily (24-hour) ridership rose with residential densities – both for weekdays and weekend days.[3] Each additional household within 500 meters of a station added 1.75 trips per weekday and 1.83 trips per weekend day, all else being equal.[4] Having a mall and other commercial activities at a station, moreover, yielded appreciable gains in ridership. Location on the MTR network also mattered. Ridership was higher at stations that were relatively far away from other stations (i.e., had large catchments) and declined with distance from the Central Station. Because of its newness and the relative sparseness of development on Hong Kong's west side, being on the Tung Chung line lowered ridership (compared to other rail corriodor). Service connectivity also mattered. MTR's patronage tended to be higher at stations with transfer connections to KCR and good feeder bus services.

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[3] Using daily statistics provided by MTRC for all 365 days in 2005, the dependent variables were expressed as "average" weekday (averaged over the five weekdays for the 52 weeks of the year) and weekend day (averaged over Saturday and Sunday for the 52 weeks of the year).

[4] This estimate is lower than the 1.97 additional station entries per public or private housing unit within 500 meters of a station found by Tang et al. (2004). The difference could be due to several factors: their model used 2001 (instead of 2005) data, was based on 19 (versus 51 stations), and excluded subsidized units.

Table 6.1. Base Ridership Models. Prediction of Average Daily Ridership in 2005 for Weekdays and Weekend Days, N = 51

	Weekday Model *1*		**Weekend Day Model *1***	
	Coeff.	**P-Value**	**Coeff.**	**P-Value**
Density: HHs w/in 500m	**1.75**	**.003**	**1.83**	**.004**
Commercial Station (0-1)	**68,428**	**.000**	**50,776**	**.000**
Catchment Size: avg. dis. to nearest 2 stations	**1,007**	**.000**	**898**	**.049**
Time from Center: Travel time from Central Station	**-2,493**	**.008**	**-1,819**	**.059**
Tung Chung Line (0-1)	**-62,189**	**.004**	**-52,373**	**.019**
KCR Transfer Sta. (0-1)	**69,793**	**.001**	**69,238**	**.001**
M Feeder Bus Lines: No.	**8254**	**.001**	**6,840**	**.007**
Constant	**64,916**	**.766**	**43,548**	**.024**
R Square	.719		.601	

R+P Ridership Model

Denoting whether an MTR station had a R+P project using a dummy variable failed to improve the base models' predictive powers, as shown in Table 6.2. Surprisingly, not only was this dummy variable statistically insignificant but it also had a negative sign. While not a lot can be inferred from this result due to high statistical insignificance, clearly R+P, by itself, has had little influence on MTR patronage. Of course, as an instrument for financing railway investments, the generation of rail traffic was never its primary intent. Regardless, there is nothing generic about R+P that increases ridership, whether on weekdays or weekends.

Table 6.2. R+P Ridership Models. Marginal Influences of R+P on Average Daily Ridership in 2005 for Weekdays and Weekend Days: N = 51

	Weekday Model 2		Weekend Day Model 2	
	Coeff.	**P-Value**	**Coeff.**	**P-Value**
Density: HHs w/in 500m	**1.77**	**.004**	**1.88**	**.004**
Commercial Station (0-1)	**68,443**	**.000**	**50,803**	**.001**
Catchment Size: avg. dis. to nearest 2 stations	**1,009**	**.000**	**902**	**.050**
Time from Center: Travel time from Central Station	**-2,546**	**.008**	**-1,909**	**.055**
Tung Chung Line (0-1)	**-60,760**	**.006**	**-49,951**	**.030**
KCR Transfer Sta. (0-1)	**67,913**	**.002**	**66,104**	**.003**
M Feeder Bus Lines: No.	**8,477**	**.001**	**7,217**	**.007**
R+P Station (0-1)	**-3,443**	**.766**	**-5,8312**	**.633**
Constant	**66,664**	**.001**	**46,507**	**.024**
R Square	**.720**		**.603**	

<u>TOD Ridership Model</u>

Does designing an R+P project with TOD elements – such as at Hang Hau, Tung Chung, and Hong Kong stations -- also have an insignificant or even negative effect on ridership? To the contrary, we would expect high-quality designs and attractive amenities to positively influence ridership and this was indeed borne out, as shown in Table 6.3. Controlling for factors like density, location, and inter-modal connectivity, the results suggest R+P projects that embody TOD designs have positive and appreciable impacts on ridership.[5] This held for both weekdays and weekends. Thus while R+P as a generic product is not associated with ridership, "R+P as TOD" clearly is.

[5] This ridership bonus is no doubt due to factors in addition to transit-oriented design. It is likely that other attributes of stations that were dummy-coded as "TOD" also account for ridership bonus. These results should thus be interpreted as suggestive of a ridership premium and not as precise estimates.

Table 6.3. TOD Ridership Models. Marginal Influences of R+P with TOD Designs on Average Daily Ridership in 2005 for Weekdays and Weekend Days, N = 51

	Weekday Model *3*		**Weekend Day Model *3***	
	Coeff.	**P-Value**	**Coeff.**	**P-Value**
Density: HHs w/in 500m	**1.88**	**.002**	**1.97**	**.002**
Commercial Station (0-1)	**68,131**	**.000**	**50,469**	**.000**
Catchment Size: avg. dis. to nearest 2 stations	**1,151**	**.000**	**1,046**	**.023**
Time from Center: Travel time from Central Station	**-2,711.1**	**.003**	**-2,044**	**.033**
Tung Chung Line (0-1)	**-89,940**	**.000**	**-80,991**	**.004**
KCR Transfer Sta. (0-1)	**78,413**	**.002**	**78,159**	**.000**
M Feeder Bus Lines: No.	**8,173**	**.001**	**6,756**	**.007**
TOD R+P Station (0-1)	**35,853**	**.080**	**36,975**	**.088**
Constant	**62,473**	**.001**	**41,027**	**.030**
R Square	**.739**		**.628**	

TOD Type Ridership Model

To further refine the analysis, R+P stations dummy-coded as TOD were further distinguished by type, defined in Chapter Three. Table 6.4 reveals that large-scale residential TOD projects, such as Tung Chung, were associated with the biggest ridership gains, followed by two other types: mid-rise residential and large-scale mixed-use. Relationships were statistically weaker for these latter two groups. While stations on the Tung Chung line tended to average substantially lower weekday and weekend ridership than other stations, controlling for other factors, in the case of Tung Chung station, this lower ridership was appreciably offset by the benefits conferred by TOD design.

Table 6.4. TOD Influences by R+P Types. Marginal Influences of TOD Designs by Three R+P Types on Average Daily Ridership in 2005 for Weekdays and Weekend Days, N = 51

	Weekday Model *4*		Weekend Day Model *4*	
	Coeff.	**P-Value**	**Coeff.**	**P-Value**
Density: HHs w/in 500m	**1.83**	**.003**	**1.97**	**.003**
Commercial Station (0-1)	**68,089**	**.000**	**49,848**	**.001**
Catchment Size: avg. dis. to nearest 2 stations	**1,066**	**.000**	**1,044**	**.046**
Time from Center: Travel time from Central Station	**-2,734**	**.030**	**-2,081**	**.034**
Tung Chung Line (0-1)	**-92,768**	**.005**	**-87,810**	**.011**
KCR Transfer Sta. (0-1)	**79,288**	**.000**	**79,855**	**.001**
M Feeder Bus Lines: No.	**8,519**	**.001**	**7,050**	**.006**
TOD Mid-Rise Residential R+P (0-1)	**29,589**	**.194**	**30,510**	**.209**
TOD Large-Scale Residential R+P (0-1)	**62,761**	**.072**	**58,096**	**.116**
TOD Large-Scale Mixed-Use R+P (0-1)	**29,777**	**.454**	**41,945**	**.324**
Constant	**64,555**	**.001**	**41,609**	**.035**
R Square	**.746**		**.633**	

TOD-Density Interaction Ridership Model

A final refinement introduced involved interacting the TOD dummy variable and the residential density variable. The results, shown in Table 6.5, suggest that R+P projects with TOD designs in dense residential settings get a proportional bump in ridership. Indeed, the model indicates that averaged over the week, the addition of one household within 500 meters of an MTR station adds 1.64 trips per day. If the station has an R+P project with a TOD design, each new household adds 2.84 daily rail trips (i.e., 1.64 + 1.20). There are clearly synergies at work: (R+P) + (TOD) + (Density) = Ridership Bonus.

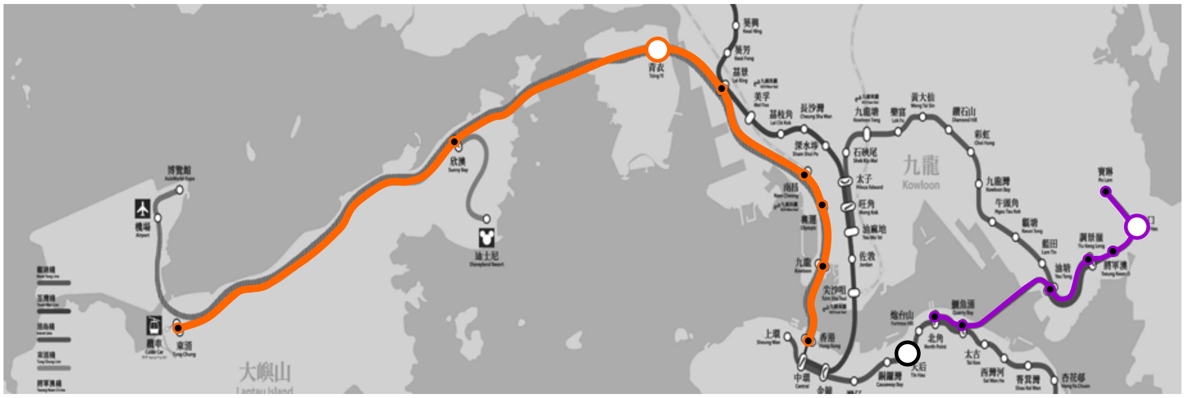
Table 6.5. Interaction of TOD-Density Model. Marginal Influences of TOD Designs in Higher Density Settings on Daily Ridership Averaged Over 7-Day Weeks: 2005 Data, N = 51

	Weekly Model	
	Coeff.	**P-Value**
Density: HHs w/in 500m	**1.64**	**.006**
Commercial Station (0-1)	**68,832**	**.000**
Catchment Size: avg. dis. to nearest 2 stations	**1,015**	**.020**
Time from Center: Travel time from Central Station	**-2,561**	**.006**
Tung Chung Line (0-1)	**-69,968**	**.002**
KCR Transfer Sta. (0-1)	**71,110**	**.001**
M Feeder Bus Lines: No.	**8,189**	**.000**
Density & TOD Interaction (0-1)	**1.203**	**.256**
Constant	**66,969**	**.001**
R Square	**.728**	

6.3 R+P, TOD, and Housing Prices

To examine the influences of R+P, TOD, and other factors on residential housing prices, three MTR stations with R+P projects were selected for case analyses.[6] The three cases – Tin Hau, Hang Hau, and Tsing Yi – capture different phases of R+P development. As shown in Figure 6.1, Tin Hau lies on MTR's original Urban Line on Hong Kong island. It thus represents MTRC's early-generation of R+P projects in contrast to the other two cases. Situated on the TKO Line, Hang Hau station was built in the early 2000s in concert with a major redevelopment campaign on Hong Kong's east side. And modern, mixed-use Tsing Yi station, a midway stop on the Airport Express Line, opened in the late 1990s.

[6] Initially, work was carried out on modeling the influences of R+P on office and commercial-retail rents. However, insufficient number of observations on rental transactions prompted us to focus on residential housing instead.



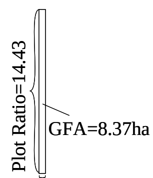
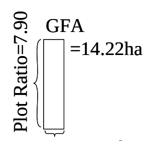
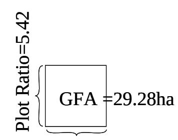
	Urban Line	TKO Line	Airport Line
Station	**Tin Hau**	**Hang Hau**	**Tsing Yi**
R+P Project Residential Use	 Plot Ratio=14.43 GFA=8.37ha Site Area=0.58ha 83.9% of GFA	 Plot Ratio=7.90 GFA =14.22ha Site Area=1.80ha 72.9% of GFA	 Plot Ratio=5.42 GFA =29.28ha Site Area=5.4ha 97.5% of GFA
Catchments	< 200m	< 400m	< 400m and >400m
Transaction Sampling	N=305 *All Available Data* 60 from R+Ps 245 from Non R+Ps	N=300 *Random Sample* 100 from R+Ps 100 from TOD 100 from Non R+Ps	N=300 *Random Sample* 100 from R+Ps 100 from Non R+Ps <400m 100 from Non R+Ps >400m
Expected Outcome	-R+P Premium -R+P Impact <200m	-R+P Premium -TOD Premium <400m	-R+P Premium -TOD Premium to >400m

Figure 6.1. MTR Station Cases for Studying Housing Price Impacts. R+P Project Characteristics, Catchment Sizes, Transaction Sampling, Expected Outcome

Figure 6.1 compares the three case settings in terms of R+P project characteristics, catchment sizes, sales transaction sampling, and expected influences of R+P and TOD on housing prices. All housing sales transactions occurred in 2005. Proprietary sales data for private housing were obtained from a real-estate brokerage company, EPRC Ltd.[7] Samples of around 300 housing sales transactions were generated for each of the three cases.

[7] See: http://www.erpc.com.hk. Only private housing sales were studied. Public and subsidized housing were not.

In the analyses that follow, two approaches are used to infer possible price premiums attributable to R+P and TOD: (1) matched-pair comparisons; and (2) hedonic price models. With matched pairs, private residences that were sold within the same station catchment are divided into two or more groups (e.g., units in R+P projects versus those that are not). Mean sales prices per square foot were computed and compared. The ratio of differences were assumed to represent rent premiums (e.g., attributable to being R+P). Matched-pair comparisons invoke the *ceteris paribus* assumption, which of course is never exactly true – all housing units vary in ways other than some being R+P projects and others not. Factors like mountain views, building quality, and site amenities are assumed to be equivalent for the comparison groups. The fact that units are within the same catchment and all are private (versus public or subsidized units), however, means they are fairly comparable in many respects.

In contrast to the matched-pair approach, hedonic price modeling involves using a multiple regression model to explicitly account for the influence of specific factors, like building age and floor level of the unit, on housing prices. Hedonic price theory assumes that most consumer goods comprise a bundle of attributes and that the transaction price can be decomposed into the component (or 'hedonic') prices of each attribute (Rosen, 1974). Similar to the ridership models, dummy variables are included in hedonic models to indicate whether a housing unit is part of an R+P development and if the project has a TOD design. Price premiums are inferred by taking the ratio of the hedonic coefficient on the R+P or TOD dummy variable relative to the average sales price per square foot for all sampled units.

Tin Hau Case

Because of high urban densities and close station spacing, the walking catchments of stations along MTR's Urban Line tend to be fairly restricted in size. In the case of Tin Hau, most housing built in conjunction within the station lies within 200 meters of the faregate entrance. Figure 6.2 shows the two residential complexes (called Park Tower) built as part of Tin Hau's R+P project lie immediately west of the station. Non-R+P housing lies farther away but still within the easily walkable 200 meter catchment.

Results from the matched-pair comparison of private housing at Tin Hau – R+P versus Non-R+P – are presented in Table 6.2. While the two housing types are not exactly equivalent (e.g., non-R+P housing tends to be older and the buildings are not as tall), they nonetheless share the main characteristic of lying near the

Tin Hau station. Comparing the mean housing prices per square foot, one can infer that units at Park Tower sell for a 79% premium ($8,465/$4,723). Being next to the station and part of an R+P project, we believe, account for much of this value-added. These mean differences are statistically significant.[8]

The second analysis of Tin Hau's housing market, based on the hedonic price model, is shown in Table 6.7. In contrast to the simpler matched-pair comparison, the hedonic model specifically controls for factors that explain housing price, like a building's age, distance from MTR station, and amenities (e.g., park) and the sold unit's floor within the building and size.[9] The model reveals that in 2005, housing prices for units sold within 200 meters of the MTR station fell with building age and increased with floor level, unit size, and distance from station (which likely reflects the benefit of lying a buffer distance from the station but still within an easy walk). Having a nearby park and main road also increased value. And controlling for all of these factors, if the unit was within the Park Tower (R+P) building, it tended to sell for HK$1,331 per square foot more. Given the mean value of sold R+P units, we infer the premium associated with R+P housing at Tin Hau is 15.7% (HK$1,331/HK$8,465). This is considerably below that estimated using the matched-pair results and, we feel, likely more representative of the true premium because of the improved model specification.

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[8] The t statistics were generated using "difference of means" tests, assuming separate variances for the two groups.

[9] Even though the dependent variable, housing sales price, controls for square footage of the unit, the inclusion of unit size as an explanatory variable allows the marginal influences of scale on prices to be captured.

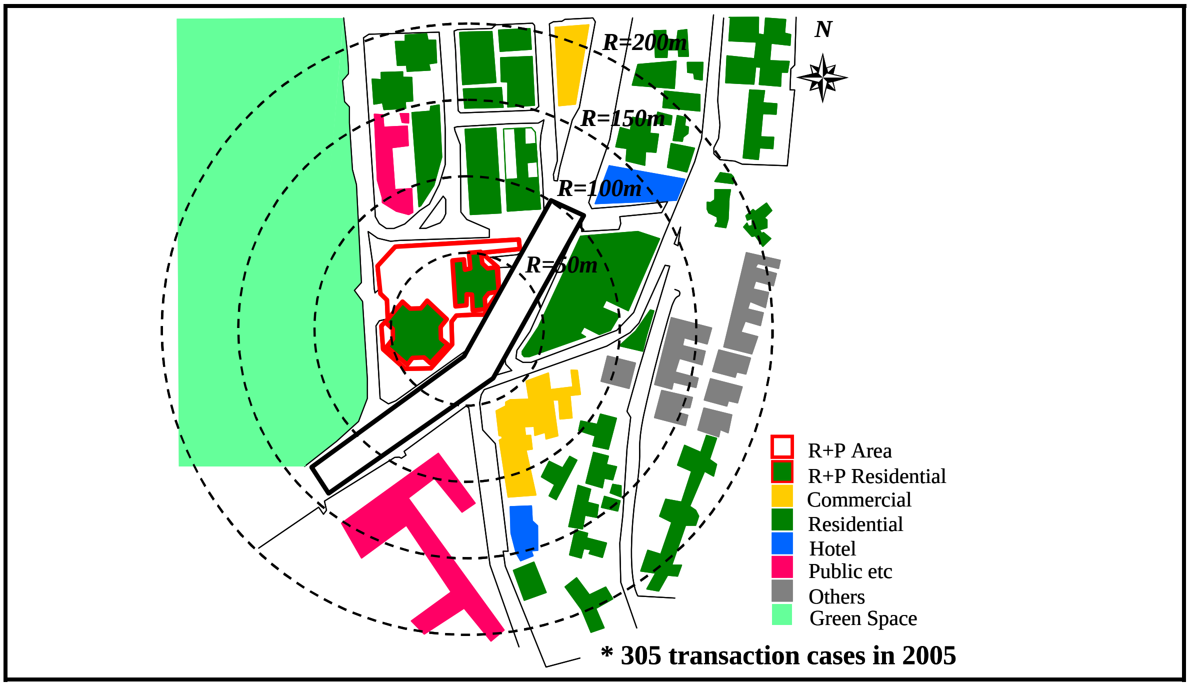

Figure 6.2. Tin Hau Station and Buildings within 200 Meter Catchment

Table 6.6. Matched Pair Results for Tin Hau Case. Comparison of Building Characteristics and Mean Housing Prices per Square Foot for R+P and Non-R+P Residential Development within 200 Meters of Station, 2005

	R+P *Park Tower*	**Non R+P (< 200m of station)**
Age in 2005 (years)	16	2 to 27
Bldg. Floors	10 to 45	1 to 33
Net Area (sq. ft.)		
Mean	1,020	646
Range	923 to 1,857	291 to 1,492
Housing Price per sq. ft. (HK$)		
Mean	8,465	4,722
Range	3,571 to 13,843	670 to 4,723
Std. Deviation	1,997	2,140
t statistic (prob.)	12.83 (.000)	
No. of Sampled Sales Transactions	60	245

Table 6.7. Hedonic Price Model Results for Tin Hau Case. Marginal Influences of R+P Residential Development on Housing Prices per Square Foot for Housing within 200 Meters of Station, 2005

	Coeff.	t Statistic	P-Value
Age in 2005 (Years)	**-105.4**	**-8.67**	**.000**
Floor of Building	**33.5**	**3.32**	**.001**
Unit Size (net area in square feet)	**2.06**	**5.15**	**.000**
Distance to MTR Station: meters	**12.57**	**4.68**	**.000**
Park: Green Space or Park at or next to sold unit's building (0-1)	**1213.7**	**3.93**	**.000**
Main Road: Trunk Road next to sold unit's building (0-1)	**1078.4**	**4.15**	**.000**
R+P Project (0-1)	**1330.8**	**2.04**	**.043**
Constant	**3203.4**	**4.13**	**.000**
R Square	**.697**		

Hang Hau Case

As part of the massive redevelopment underway along MTR's TKO Line, the Hang Hau station has witnessed a sizeable amount of residential development over the past decade – some through R+P though most not. As Figure 6.3 reveals, the R+P housing, called Residential Oasis, consists of six towers adjacent to the station situated above a mall. Between 100 and 300 meters of the station lies 20 towers of private housing that pre-date Residential Oasis. Because these buildings are likewise surrounded by retail shops and also enjoy direct connections to the Hang Hau station (via skybridges), these units embody many features of TOD. In our analysis, we thus refer to them as "Non R+P TOD". The third type of housing at Hang Hau tends to be older and farther from the station, has no adjacent retail, and does not directly connect to the station via skybridges. We referred to these units as "Non-R+P/Non-TOD".

Table 6.8 compares attributes of 100 randomly sampled housing units among the three groups that lie within 500 meters of the Hang Hau station. Building heights are seen to taper with distance from the station and average unit sizes among the three groups are fairly similar.

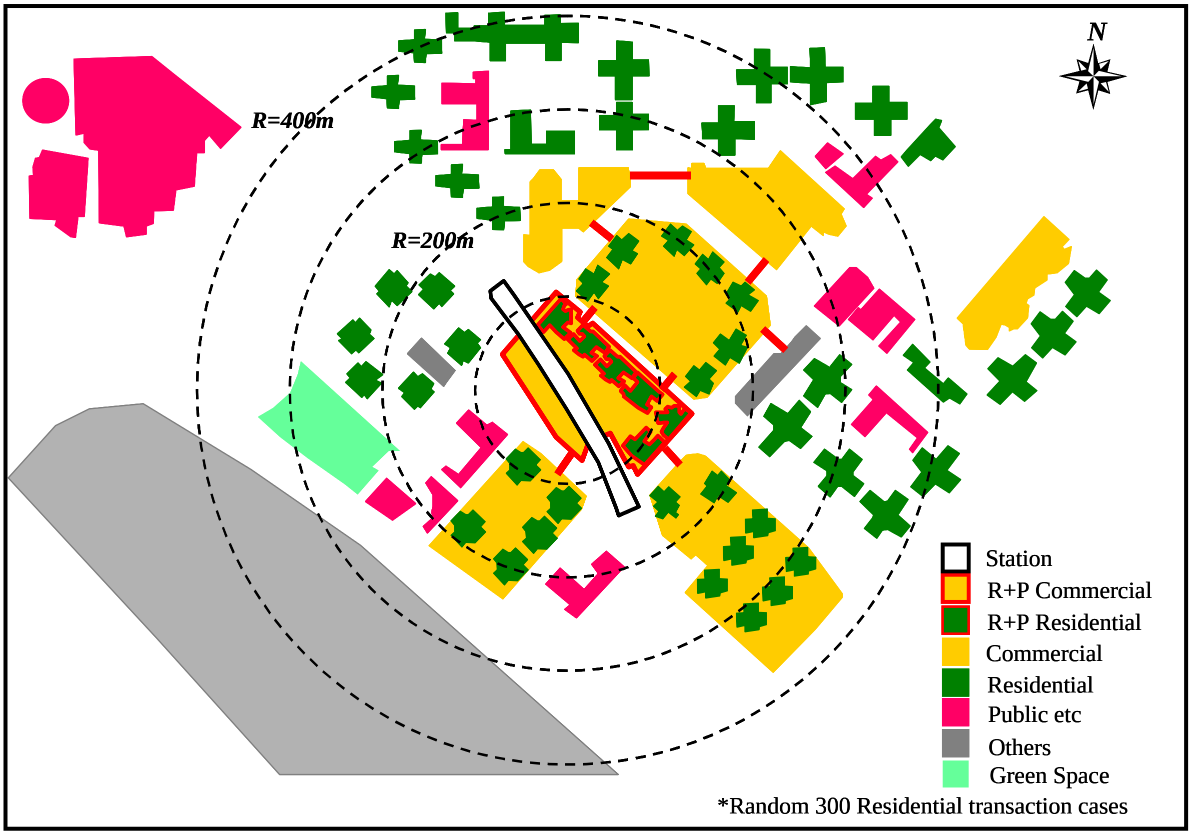

Figure 6.3. Hang Hau Station and Buildings within 500 Meter Catchment

Table 6.8 also shows the matched-pair results on mean housing prices. Compared to TOD housing not built through R+P, the R+P units enjoyed an average premium of 26% ($5,395/$4,277). Compared to private non-TOD housing, R+P units sold, on average, for more than twice as much per square foot -- HK$5,395 versus HK$2,559. Differences are statistically significant.

In estimating the hedonic price model for the 300 sampled private units sold near the Hang Hau station in 2005, variables measuring a unit's age, distance to station, and TOD status (coded 0-1) were found to be highly inter-correlated.[10] This is because the units with TOD designs (i.e., mixed land uses and direct pedestrian connections to the station) are relatively new and concentrated near the MTR station. For this reason, three separate multiple regression equations were run for assessing the influence of R+P on housing prices, distinguished by whether "Age", "Distance to MTR Station", or "TOD" was used as an explanatory control variable.

[10] All correlations among these three variables were above 0.72 in absolute terms.

Model 1 in Table 6.9 shows that, when using "Age" of unit as a predictor, R+P provides a modest premium of 5.7% (i.e., $290.5/$5,395, the denominator being the average price of sold R+P units). With "Distance" as a predictor, the table reveals even a higher premium: 8.0% ($430.3/$5,395). The influence of the "Distance" variable in Model 2 is negative, suggesting that being near a high-amenity station adds value. Lastly, the third model in Table 6.9 indicates a sizable premium for the status of being an R+P project, however this is supplemented by a bonus associated with being TOD.[11] The estimated premium for units in Residential Oasis relative to non-R+P/non-TOD projects, then, is 100% [i.e., ($939.1 + $1,636.5)/$2,558.9, the denominator representing the average price for non-R+P/non-TOD units]. Relative to other TOD units that are not R+P, the premium is 22% (i.e., $939.1/$4,277.2, the denominator representing the average price for non-R+P TOD units). Although below the premiums predicted using the matched-pair approach, the premiums estimated using hedonic models are considerably higher than those estimated for the older Tin Hau project.

Tsing Yi Case

MTR's Tsing Yi station, on the Airport Extension line, is noted for its modern Maritime Square shopping mall as well as the exclusive Tierra Verde condominium complex that arcs along the waterfront. Figure 6.4 shows a 400 meter catchment around the Tsing Yi station, which not only encompasses the channelway but also spans institutional uses (e.g., a large sports park) and considerable amounts of non-residential activity including a community park. Relative to the Tierra Verde R+P complex (Photo 6.1), only two other housing projects are truly comparable in terms of housing quality and project scale and thus are potential candidates for matched pairs. One Villa Esplanada, lies to the north of Tsing Yi within 400 meters of the station. The other, Greenfield Garden, lies to the south, beyond the 400 meter ring. The matched-pair analysis, thus, is based on residential packages of comparable scale and quality within the vicinity of Tsing Yi station.

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[11] Statistically, the R+P dummy denotes whether a housing unit is part of the Residential Oasis R+P project. The TOD dummy indicates whether the unit lies in a building in a TOD setting (i.e., mixed uses and connected to the station either directly or via skybridges). The 200 sampled TOD units include those that are R+P and non-R+P. Thus, all R+P units are scored 1 for the R+P and TOD dummies however non-R+P TOD units receive a 1 value only for the TOD dummy variable.

Table 6.8. Matched Pair Results for Hang Hau Case. Comparison of Building Characteristics and Mean Housing Prices per Square Foot for R+P, Non-R+P TOD, and Non R+P/Non-TOD Residential Development within 500 Meters of Station, 2005

	R+P ***Residential Oasis***	**Non R+P TOD**	**Non R+P/ Non-TOD**
Age in 2005 (years)	1	6 to 8	6 to 15
Bldg. Floors	5 to 59	1 to 47	1 to 39
Net Area (sq. meters)			
Mean	593	510	517
Range	494 to 956	380 to 817	213 to 651
Housing Price per sq. ft. (HK$)			
Mean	5,395	4,277	2,559
Range	3,744 to 7,076	3,227 to 5,217	1,658 to 3,117
Std. Deviation	609	324	381
t statistic (prob.)		2.261 (.012) *	7.536 (.000) **
No. of Sampled Sales Transactions	100	100	100

* Difference of Means t statistic between R+P and Non R+P TOD; one-tailed test

** Difference of Means t statistic between R+P and Non R+P/Non-TOD; one-tailed test

Table 6.9. Hedonic Price Model Results for Hang Hau Case. Marginal Influences of R+P Residential Development on Housing Prices per Square Foot for Housing within 500 Meters of Station; Three Models Based on Control Variables, 2005

	Model 1 (with Age Variable)		**Model 2 (with Distance Variable)**		**Model 3 (with TOD Variable)**	
	Coeff.	**P-Value**	**Coeff.**	**P-Value**	**Coeff.**	**P-Value**
Floor of Building	**20.5**	**.000**	**19.0**	**.001**	**13.5**	**.000**
Unit Size (net area in square feet)	**0.97**	**.000**	**0.561**	**.096**	**1.00**	**.000**
Age in 2005 (Years)	**-179.2**	**.000**	**--**	**--**	**--**	**--**
Distance to MTR Station: meters	**--**	**--**	**-4.99**	**.000**	**--**	**--**
TOD (0-1)	**--**	**--**	**--**	**--**	**1636.5**	**.000**
R+P Project (0-1)	**290.5**	**.048**	**430.3**	**.006**	**939.1**	**.000**
Constant	**4085.4**	**.000**	**4052**	**.000**	**3203.4**	**.000**
R Square	**.745**		**.719**		**.899**	

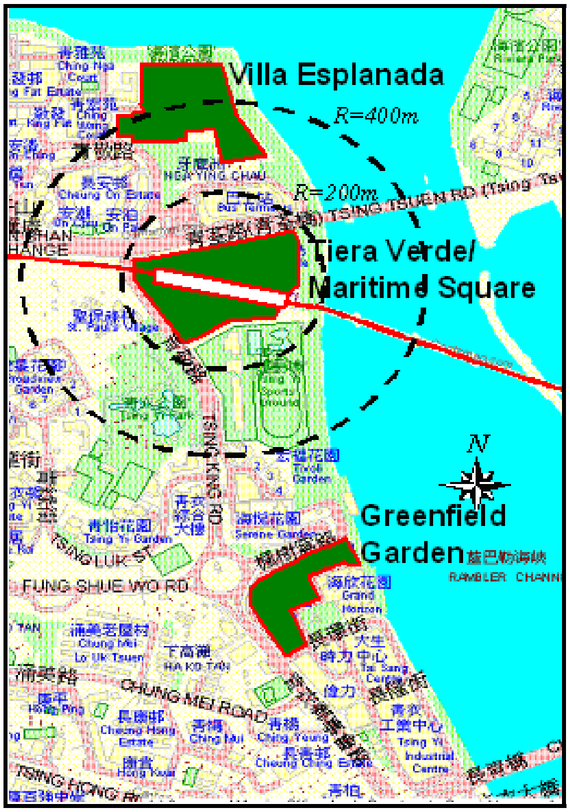

Figure 6.4 and Photo 6.1. Tsing Yi Station Area and Three Comparison Housing Complexes (Left); Tierra Verde Above Maritime Square at Tsing Yi Station (Right)

A comparison of the three residential complexes in 2005 (Table 6.10) shows that while Tierra Verde and Villa Esplanada are quite comparable, Greenfield Garden is not only farther from the station, but units are also older and smaller (and thus less modern). Although the validity of price comparisons between Tierra Verde and Greenfield Garden is questionable, the hedonic price models that follow control for these factors by explicitly including them in the equation. As expected, the paired comparisons of mean rents in Table 6.10 reveal big differences between Tierra Verde and Greenfield Garden (a 68.9% differential) and inconsequential ones between Tierra Verde and Villa Explanada.

Table 6.10. Matched Pair Results for Tsing Yi Case. Comparison of Building Characteristics and Mean Housing Prices per Square Foot for Three Comparison Projects, 2005

	R+P TOD *Tierra Verde*	**Non R+P** (< 400m) *Villa Esplanada*	**Non R+P** (> 400m) *Greenfield Garden*
Age in 2005 (years)	6	4	16
Bldg. Floors	8 to 52	1 to 45	2 to 39
Net Area (sq. meters)			
Mean	643	664	424
Range	435 to 796	508 to 859	379 to 513
Housing Price per sq. ft. (HK$)			
Mean	5,648	5,406	3,344
Range	3,046 to 7,035	3,021 to 6,579	2,078 to 4,154
Std. Deviation	569	564	352
t statistic (prob.)		0.512 (.305) *	33.286 (.000) **
No. of Sampled Sales Transactions	100	100	100

* Difference of Means t statistic between Tierra Verde and Villa Esplanada; one-tailed test

** Difference of Means t statistic between Tierra Verde and Greenfield Garden; one-tailed test

The hedonic price model shown in Table 6.11 reveals that units in the Tierra Verde R+P enjoyed a significant rent premium over those in the other two developments, controlling for a unit's age, floor level within a building, and size. The 4.7% price differential was due mainly to differences between Tierra Verde and Greenfield Garden cases.[12] A second model in Table 6.11 denotes units in both Tierra Verde and Villa Esplanada as TODs (based on their mixed-use surroundings and attractive pedestrian amenities). Here, the premium associated with TOD design is even greater: 34.2%.[13]

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[12] This differential equals the ratio of HK$263.1 to the average price for R+P units (i.e., Tierra Verde units) of HK$5,647.7.

[13] This differential equals the ratio of HK$1,933.1 to the average price for TOD units (i.e., Tierra Verde and Villa Esplanada) of HK$5,647.7.

Table 6.11. Hedonic Price Model Results for Tsing Yi Case.
Marginal Influences of R+P and TOD Residential Development
on Housing Prices per Square Foot, 2005

	Model 1 *R+P Model*		Model 2 *TOD Model*	
	Coeff.	**P-Value**	**Coeff.**	**P-Value**
Age in 2005 (Years)	**-163.88**	**.000**	**--**	**--**
Floor of Building	**16.27**	**.000**	**15.71**	**.000**
Unit Size (net area in square feet)	**1.01**	**.000**	**1.04**	**.001**
R+P Project (0-1)	**263.1**	**.000**	**--**	**--**
TOD (0-1)	**--**	**--**	**1933.1**	**.000**
Constant	**5230.5**	**.000**	**2609.5**	**.000**
R Square	**.856**		**.855**	

Summary on Price Effects

The analyses unearthed evidence that R+P yields significant premiums relative to fairly comparable non-R+P housing projects. Also important is transit-oriented designs. Table 6.12, which summarizes the results, reveals fairly substantial premiums associated with both R+P and TOD based on matched-pair results. These premium estimates were substantially higher than the premiums of HK$98 to HK$280 per square foot (over the 1994 to 2004 period) found by Tang et al. (2004). We note that in our analyses, not all of the pairs were ideally comparable, which could account for differences between the two studies. Also, the premium estimates from our hedonic price results, which explicitly controlled for potential confounders in the analyses, are not as high as the matched-pair results but likely better reflect true price premiums. Similar to the ridership model findings, benefits associated with R+P were greatest for newer-generation projects, as reflected by experiences at the Hang Hau and Tsing Yi stations. And there are hints that the combination of R+P and transit-oriented designs produces synergistic effects – proportionally higher rents in addition to ridership bonuses.

Table 6.12. Summary of Housing Price Effects Associated with R+P and TOD

	Urban Line	TKO Line	Airport Line
Station	Tin Hau	Hang Hau	Tsing Yi
Sales Price Means (HK$)			
R+P	8,465	5,395	5,648
TOD	--	4,277	5,606
Non R+P	4,722	--	--
Non TOD	--	2,589	3,343
R+P Premium *from Matched Pairs* (HK$)			
TOD	--	$1,118 (26.1%)	42 (0.8%)
Non R+P	3,743 (79.0%)	--	--
Non TOD	--	2,806 (110.8%)	2,305 (70.0%)
R+P Premium *from Hedonic Models* (HK$)	1,330.8 (15.7%)	290.5 to 939.1 (5.3% to 17.4%)	263.1 (4.7%)
TOD Premium *from Hedonic Models* (HK$)	--	1,637 (38.3%)	1,933 (34.2%)

The presence of price premiums at R+P projects and in TOD settings could be expected to spur real-estate developers to redevelop land for higher-value uses. Indeed, Tang et al. (2004) found evidence that the presence of MTR stations encouraged property redevelopment. In reviewing applications for commercial-office redevelopment, they found most planned redevelopment sites were within 400m of an MTR station. They conclude private land owners and developers enjoy a "halo effect" from the presence of a railway station, prompting them to maximally exploit the benefits conferred by developing their landholdings to the highest potential use. In the absence of comprehensive planning, the small, somewhat piecemeal approach to in-situ redevelopment does not necessarily add up to a cohesive set of land developments. However, when master-planned according to TOD principles, as reflected by projects like Hang Hau and Tsing Yi, the evidence suggests that land-price premiums of redevelopment can be substantial.

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Chapter Seven

R+P in a Regional Context

7.1 Visioning Hong Kong's Future

Rail transit has always played a central role in advancing visions of future settlement and urbanization patterns for greater Hong Kong. As reflected in a series of territorial development strategies and long-range land-use and transportation plans over the past several decades, Hong Kong's civic leaders, business community, and town planners have long understood and embraced the symbiotic relationship between rail-transit investments and city development. Coupling rail-transit and urban development has also been a cornerstone of efforts to promote sustainable patterns of urbanization and mobility in a fiscally prudent manner, as embodied by the R+P programme.

Hong Kong first grew along its waterfronts and later on harbor reclamations and landfills. MTR's early rail lines were sited in these dense, built-up parts of the city since, after all, this was where the riders were. As residential development spread outwards into the New Territories, rail investments were viewed as a way of forming a "backbone" that channels regional growth. In more recent years, railways have also served as catalysts for redevelopment, including the provision of public housing on former brownfield sites (e.g., Lok Fu and Wang Tai Sin). As Hong Kong's economic base continues to shift from traditional manufacturing to a service-based economy, more and more redevelopment possibilities will avail themselves. Economic transformation provides unprecedented opportunities for railway investments to restructure Hong Kong's physical landscape, targeting growth to infill sites and in so doing, preserving the territory's open space and natural resources. It is increasingly understood that the coordination and integration of rail transit and urban development not only yields mobility benefits but also places greater Hong Kong on a sustainable pathway.

7.2 Guided Decentralization

Hong Kong has three hierarchical levels of comprehensive planning: at the highest level, the Territorial Development Strategy[1] provides a broad land use/transport/environmental planning framework to guide future development and the provision of future infrastructure in Hong Kong; sub-regional Development Strategies, which provide a bridge between territorial and local planning for five sub-regions of Hong Kong, translating regional goals into more specific objectives; and statutory plans, which propose permissible land uses and major road systems for individual districts, backed by zoning and development guidelines.[2] At the territorial and sub-regional levels, development strategies are complemented by a transportation component. In the case of the Territorial Development Strategy, Railway Development Strategies have been prepared in parallel, to both serve and guide growth. In 1991, a comprehensive regional plan, *Metroplan,* was approved that served as a spatial referent for territorial and sub-regional development strategies, tying policies to places and corridors. *Metroplan* stressed the importance of planning and developing land use and transport in mutually reinforcing and self-sustaining ways, as reflected in the 1991 report: "The metropolitan area will be served by a high capacity, multi-modal transport system with high density development concentrated around major interchanges" (Pryor, 2006, p. 60). *Metroplan* gave particular focus to redesigning the city around Victoria Harbour, setting the stage for some of MTRC's most successful R+P projects, like the IFC tower atop Hong Kong Station.[3]

The transportation elements of comprehensive development strategies have served to articulate rail transit's role in the land-use/transport nexus. The 1994 *Railway Development Strategy*, for example, explicitly embraced the "backbone" strategy through an aggressive expansion of railway services, including lines to the new international airport and New Territories, a regional express line to the mainland China border, and central-city redevelopment (e.g., Tseung Kwan O).[4] The plan assumed that 70% of future population and 80% of employment

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[1] The first Territorial Development Strategy was prepared in 1981, followed by updates in 1986, 1988, and 1991.

[2] Guiding the preparation of these plans is the *Hong Kong Planning Standards and Guidelines*, setting standards for the scale, location and site requirements of various land uses and facilities. It is used in the preparation of town plans, planning briefs, and the scrutiny of development proposals.

[3] Metroplan was endorsed by Hong Kong's Executive Council in 1991 and was subsequently carried forward to detailed planning through the preparation of a series of Development Statements for districts within the region.

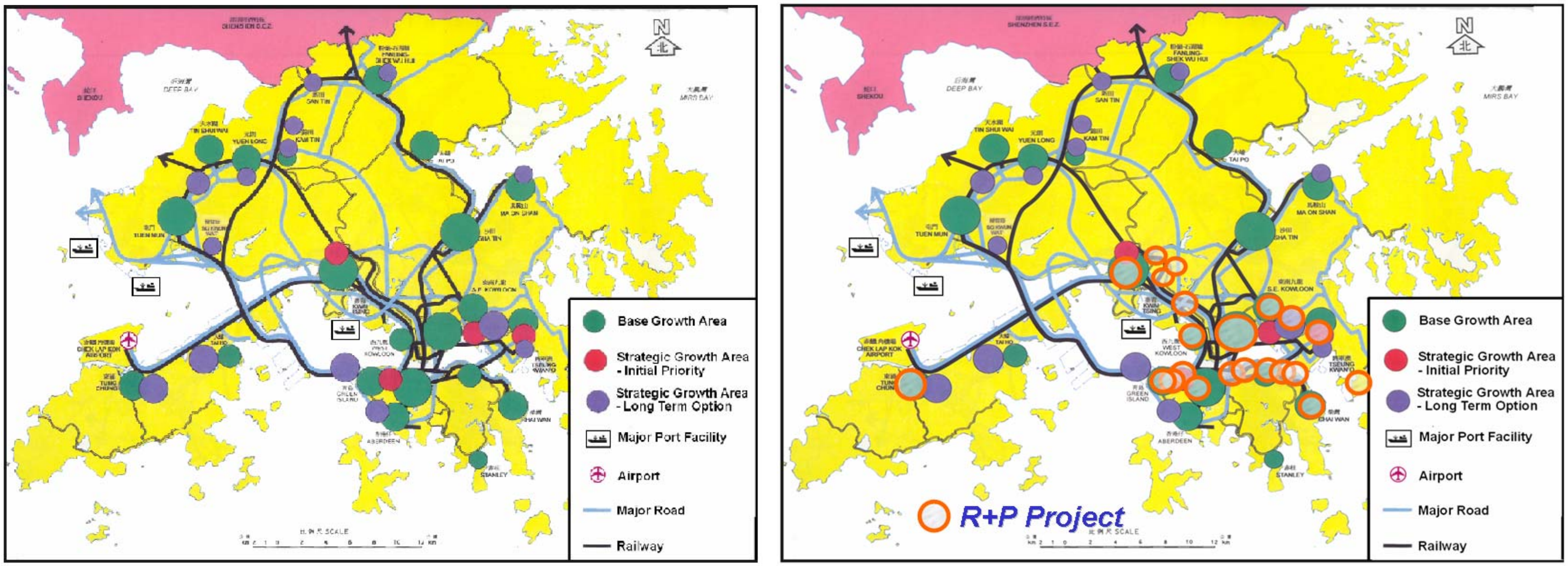
[4] Hong Kong Government, Transport Branch, *Railway Development Strategy*, December 1994.

opportunities would be within one-mile of a railway station. The plan also sought to increase rail-transit's share of motorized trips from 31% to 43% by 2016.

Borrowing a chapter from Scandinavian planning practice, Hong Kong's territorial plans have envisaged future development (called "strategic growth areas") as "strings of pearls", marked by a hierarchy of urban centers interlaced by high-quality, high-capacity rail transit along well-defined linear axes (Map 7.1, left panel). In a review of *Metroplan's* impact on rail transit, McCarthy (1996, p. 28) noted that the plan is not only sustainable but also potentially "remunerative" for MTRC since "it locates high density zones at railheads and ensures that MTR captures a high percentage of trips made from those areas", yielding "high revenue/ financial returns to MTRC". Th*e* right panel of Map 7.1 shows that R+P projects have indeed been responsive to *Metroplan*, contributing to the concentration of development in designated growth areas. Moreover, accompanying railway development strategies have called for investment in rail lines in advance of demand to shape growth, again a practice long practiced in sustainable transit metropolises like Stockholm and Copenhagen (Cervero, 1998). The 1998 *Territorial Development Strategy*, for example, notes: "As a matter of principle, it is considered that provision should, where practical, be made for new passenger rail systems ahead of or at least parallel with the development of new strategic growth areas".[5] Hong Kong's *Railway Development Strategies* of 1994 and 2000 explicitly called for using increments of property value gains to finance railway investments in advance of development, a cornerstone of MTR's R+P programme. Brownlee (2001) contends R+P has not anticipated but rather responded to development, charging "this way of rail financing has meant it makes financial sense to build a rail line only when the operator can be assured of high usage", which "has caused delay in building rail to population centers" (p. 4). MTRC's recent railway investments, such as the extension to the new international airport, clearly have been in advance of market demand, consistent with recommendations of government's *Railway Development Strategies*.

That MTR stations have leveraged land development and increased densities is indisputable. Meakin (1989) contends that MTR's city-shaping capabilities, however, have been muted by the paucity of developable sites in MTR corridors

[5] Planning, Environment and Lands Bureau, Government of Hong Kong *Territorial Development Strategy Review: A Response to Change and Challenges*, 1998.



Map 7.1. Territorial Development Strategies: ***Left*** **-- Metroplan's Proposed Growth Areas forming "Strings of Pearls";** ***Right*** **– R+P Projects Contribute to Strategic Growth Areas.** Source (left panel): Planning, Environment and Lands Bureau, *Territorial Development Strategy Review: A Response to Change and Challenges,* 1999.

and constraints like airport-related height restrictions in Kowloon. Such factors, however, have had less presence along the MTRC's most recent extensions such as the new Airport Line. And without question, some of Asia's tallest skyscrapers, including Central Plaza in Wan Chai and IFC Tower at the Hong Kong Station, could not have been built without high-capacity subway services nearby. While not sufficient to accommodate high-rise commercial development, underground railway services have without question been a prerequisite. Remarks Runnacles (2006, p. 110): "It is now acknowledged that Hong Kong would be unsustainable without the MTR".

7.3 Balanced Growth

In addition to giving rise to a "string of pearls" built form, railway investments have also been turned to for achieving balanced development. The 1998 *Territorial Development Strategy* specifically called for decentralizing office growth around new rail-served employment nodes in order to achieve a better jobs-to-population balance. The aim was to convert largely dormitory communities of the New Territories to balanced, mixed-use districts, interlinked by high-quality rail services. The study noted that in addition to creating self-contained urban centers and shortening the length of trips, the balance of employment and residences also can lead to more efficient bi-directional travel flows. Aligning densities of both residences and employment sites within walkable distances of railway stations was considered essential toward increasing transit's market share of trips: "Land use planning and density targets should be set for high-density development areas that produces a distribution of population and employment such that say 60% of both dwellings and workplaces are within walk-in catchment areas (of approximately 500m radius) of railway stations".[6]

Despite the best of intentions to decentralize employment growth, to date many of Hong Kong's satellite centers have yet to attract major employers and big businesses. At the Tung Chung station, for example, only around one-quarter of office space was occupied four years following the station's opening. In Hong Kong, many employers and businesses perceive tremendous economic advantages to locating in or near traditional urban centers, weakening the market for outlying office space. This is all the more so in today's increasingly competitive global economy where information and service-based industries seek to tap into the benefits of agglomeration economies – e.g., productivity

[6] *Territorial Development Strategy Review*, 1998, pp. 82-83.

gains associated with clustering highly skilled, specialized labor. Accordingly, rail-served new towns have failed to produce the balanced development projected by planners (Leeds, 2006). In fact, from 1992 to 2002, self-containment decreased in urban areas as reflected by increases in cross-district travel (Hong Kong Transport Department, 2003)[7].

7.4 Transit Priorities and Pedestrianization

Hong Kong planners have also tied the linkage of public transport and land-use to travel-demand management, particularly over the past ten years. Several government reports emphasized the importance of tending to the mobility and safety needs of pedestrians, recognizing that all rail users are pedestrians to some degree. Travel avoidance was also stressed in past plans. The *Third Comprehensive Transport Study* (CTS-3) "recommends an integrated approach taking into account land-use and environmental planning in order to minimize the need for travel" (p. 2). CTS-3 similarly calls for placing future population and employment centres "in the vicinity of railway stations served by integrated pedestrian systems and other transport feeder services to maximize the usage of railways". It reinforces a "transit first" approach, giving the highest priority to railway expansion and forming the "backbone" of the region's transport network.

CTS-3 is notable for going further than any of its predecessors in emphasizing the value of high-quality walking environments. The report's authors write: "Pedestrianization, together with grade-separated and safe pedestrian facilities, can help reduce the number of short motorized trips, enhance road safety, increase mobility and benefit the environment" (p. 11). Furthermore, "by concentrating population and employment around railway stations, reliance on the private car will be reduced". The report further notes: "The proportion of trips that will use a rail line is very much higher within the 'walk-in' zone, which under normal conditions is typically 400m around each station". It is further pointed out that this zone can be extended considerably by provision of good walkways, separated from traffic nuisances. Serving pedestrians, moreover, should not be an afterthought, according to the report: "During the design of a rail station, or public transport interchange, active consideration should be given to providing good pedestrian access". These are not simply high-minded ideals.

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[7] Exceptions include Yuen Long and Tin Shui Wai new towns, where the share of total trips internal to the new towns rose from 13% in 1992 to 23% in 2002.

Statistics bear them out. One analysis estimated that walking distance for boarding and alighting explains 26% of transit mode choice decisions in greater Hong Kong (Hong Kong Transport Department, 2003).

7.5 Recent and Emerging Regional Plans

Future plans recognize a region in transition reflected by the shift from a traditional manufacturing economic base to more a service, information-oriented economy with increasingly strong international linkages. Its future economy will be more diverse, spanning business, finance, information, tourism, entrepot activities and manufacturing. Economic restructuring and globalization will without question place greater demands on Hong Kong's international airport and seaport facilities as well as the surface transportation facilities that serve them. De-industrialization also creates new development opportunities. Hong Kong's most recent plans reveal the shift from expanding rail-fed new towns on former greendfields to redeveloping brownfield sites previously occupied by factories and declining retail districts. *Hong Kong 2030: Planning Vision and Strategy* identified industrial zones that could be recycled into livable, mixed-use communities served by high-capacity transit. Older housing stock will also be converted into higher quality living environments. The 2030 plan acknowledges that many new towns are perceived by many residents as suffering from excessively high densities, creating "rather oppressive environments".

Hong Kong's 2030 long range plan is nearing completion at this time. It calls for a balance of redeveloping declining urban districts and new-town development in order to accommodate the 8.4 million inhabitants and 4 million employees projected for 2030.[8] Urban regeneration is to take place not only in Kowloon and the New Territories but also on southern Hong Kong Island. So far as the design of future "new towns/in town", Tseung Kwan O (TKO) is likely a bellwether – high station-area densities matched by lower surrounding densities compared to previous-generation new towns, with an emphasis on public amenities, pedestrianization, natural landscaping, and quality of environment. The 2030 plan also focuses as much on neighborhood-scale as regional-scale transport: "Within the town, people should be able to travel in environmentally friendly

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[8] Hong Kong Government Development Bureau, *Hong Kong 2030: Planning Vision and Strategy* adopts a longer time horizon than previous strategies and a wider regional perspective, weighing the implications of different development scenarios in the Pearl River Delta region of mainland China.

modes of transportation such as electric trolley buses, people movers, and travellators that are well-connected to conveniently located transport interchanges for mass transportation systems. There should be more use of pedestrian zones and walkways".[9]

The 2030 plan also re-emphasizes the importance of jobs-housing balance, noting that as the proportion of the population living in the New Territories continues to increase, the 78% share of jobs in the Main Urban Area (Kowloon and Hong Kong Island) needs to be lowered. The plan recognizes, however, that "with the increasingly service-oriented economy, the tendency of firms to agglomerate in existing business districts is high" and "therefore, there is limited opportunity for rezoning employment land in the Main Urban Area without arousing many objections".[10]

What role will R+P play in Hong Kong's future evolution? Most likely, it will be a crucial one. The inherent advantages of R+P as an effective form of value capture is in no way diminished by shifts in community design and town planning practice. However the desire of many residents for lower building heights and more neighborhood-scale open space and amenities presents both challenges and opportunities in the execution of R+P in coming years. There are obviously financial ramifications to lowering densities around railway stations since MTR's joint development income rises proportionally with plot ratios. However higher quality urban designs that appeal to the tastes preferences of the buying public means potentially higher rents per square meter. The previous chapter uncovered housing price premiums from coupling R+P with high-quality urban designs. Striking an appropriate balance between R+P as a revenue-generation instrument and a tool for building attractive, sustainable communities around MTR stations will be critical toward the programme contributing to both long-range planning visions and MTRC's corporate objectives.

Hong Kong 2030: Planning Vision and Strategy also provides new opportunities for R+P by virtue of its emphasis on enhancing linkages to mainland China. This could occur in two ways. One is through coordinating growth and railway investments in the Pearl River Delta region. The other is through programmatic expansion of value capture principles, and potentially R+P as a specific

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[9] Hong Kong Government Development Bureau, *Hong Kong 2030: Planning Vision and Strategy*, *Vision and Planning Objectives*, Objective 3.21.
[10] Hong Kong Government Development Bureau, *Hong Kong 2030: Planning Vision and Strategy*, *Stage 2 Public Consultation Digest.*

application, to planned railway improvements in the two dozen or more China cities with metropolitan rail systems on the ground or in the advanced planning stages. Such possibilities are taken up in the concluding chapter of this report.

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Part III
Comparative Experiences and Extension of R+P

How do other Asian cities with world-class railway systems finance capital investments and coordinate infrastructure and land development? Chapter Eight investigates this question by examining experiences in metropolitan Tokyo and Singapore. Tokyo and other large Japanese cities have a long tradition of private companies bundling together railway and new town development. As population growth has slowed, the increased risks of railway investments have prompted a shift toward government-supported financing of system expansion in recent years. Chapter Eight reviews recent experiences with joint railway expansion and land-development in Tokyo, focusing on public-private partnership arrangements. Though smaller in population, Singapore has achieved a remarkable amount of high-quality development around its rail stations. A fundamentally different approach to rail-infrastructure finance has been adopted in Singapore, however, one based on cross-subsidizing both public transport and housing development through high charges and fees passed on to motorists. Chapter Nine looks to the future by addressing how experiences with transit value capture and joint development in Hong Kong, Tokyo, and Singapore might be extended to other rapidly growing cities of Asia, focusing specifically on the People's Republic of China. With more than 25 large-scale rail investments either on the ground or in the works, China presents unprecedented opportunities for introducing programmes like R+P – to achieve both sustainable finance and sustainable urbanism. Key insights and lessons from this research are also presented in the closing chapter.

Chapter Eight

Comparative Experiences in Tokyo and Singapore

8.1 Geographies, Economies, and Demographics

In terms of their global economic standing and geographical settings, the city-regions of Tokyo and Singapore are worthy international comparisons to Hong Kong. Like Hong Kong, these two east-Asian megacities are known for progressive and creative approaches to transit finance and transit/land-use integration (Table 8.1).

As cities go, Hong Kong and Singapore match up reasonably well. Hong Kong has about 6.9 million inhabitants within its total area of 1,107 sq km. Singapore has some 4.3 million residents who live within a 699 sq km island territory. Hong Kong, however, has far less developable land resulting in much higher urbanized densities (26,473 people per sq km urbanized area compared to 6,211 people per sq km in Singapore). In the case of Tokyo, the area that most closely corresponds to Hong Kong in scale and population is a 15-20 km radius from the city's historical center (Edo). Referred to as Tokyo 23 Ward, this 621 sq km area is home to 8.5 million inhabitants. Its density of 13,600 inhabitants per sq km falls between that of Hong Kong and Singapore. Much larger is the Tokyo Greater Metropolitan Area (GMA), which captures the urbanized area's expansive laborshed: 13,550 km in size with 34.2 million inhabitants.[1]

Since 2000, the three city-regions have grown at contrasting rates. While Singapore's population increased by around 8 percent between 2000 and 2005, Hong Kong's population changed little over this period. Despite Japan's overall decline in population (attributable to low birth rates and limited in-migration), the Tokyo 23 Ward and Tokyo GMA witnessed population growth of 4.0% and 3.2% respectively over the past five years.

[1] In addition to the Tokyo 23 Ward, the Tokyo GMA includes the surrounding prefectures of Saitama, Chiba, Kanagawa and special administrative municipals of Yokohama, Kawasaki and Chiba.

Table 8.1. Population, Area, and Density: Hong Kong, Tokyo and Singapore, 2005

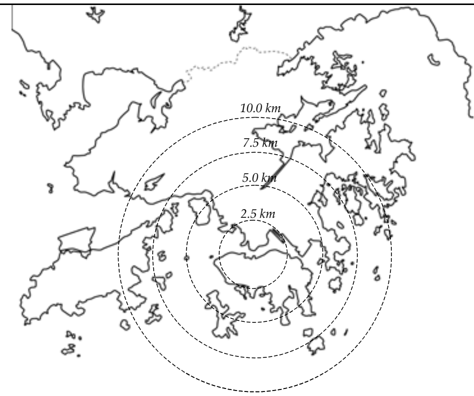
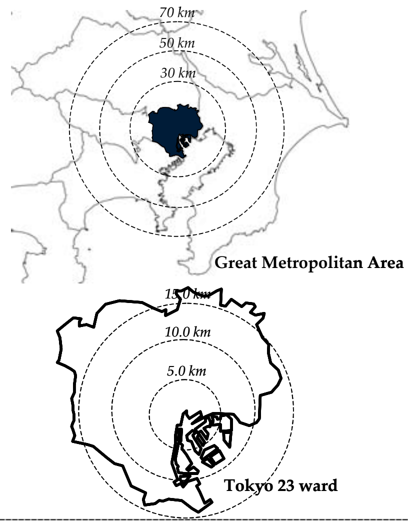
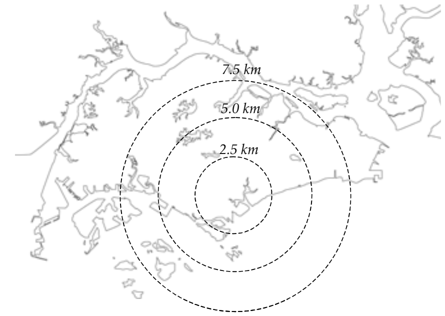
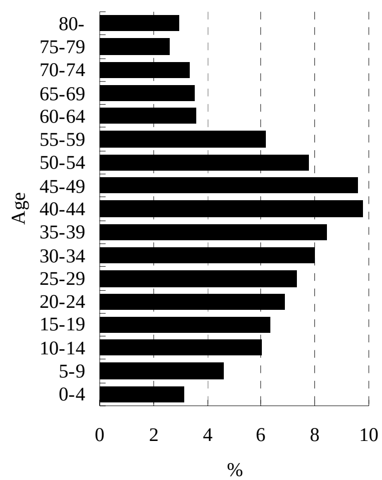
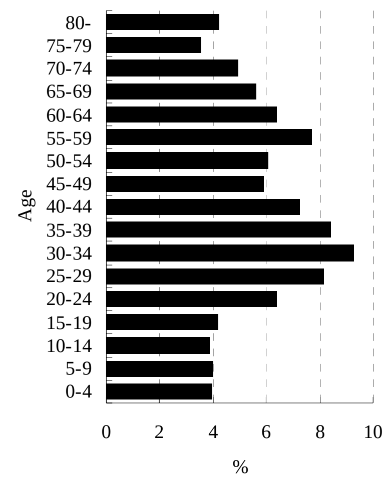
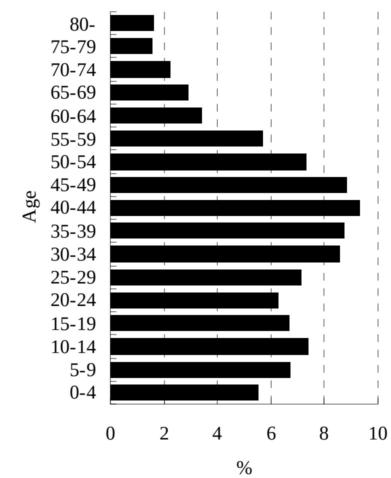
	Hong Kong	**Tokyo** *Great Metropolitan Area (upper)* *& 23 Ward (lower)*	**Singapore**
Map			
Population, 2005	6,935,900	34,196,915 8,457,418	4,341,800
Area (sq km)	1,107 (Total) 262(Urbanized Area)	13,556 621	699
Density (people per sq km), 2005	6,266 (Total) 26,473 (Urbanized Area)	2,523 13,608	6,211
Population Growth % 2000-2005	1.02	3.15 3.97	8.07

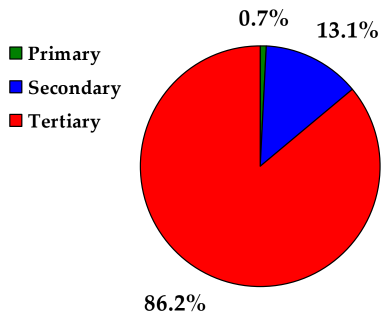
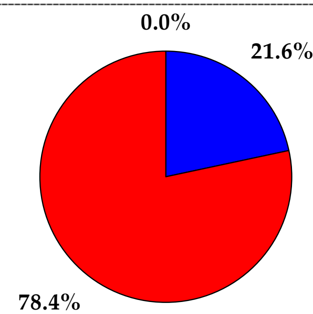
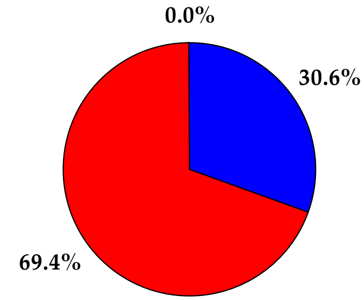
Table 8.2. Demographic Patterns: Hong Kong, Tokyo and Singapore, 2005

	Hong Kong	Tokyo 23 Ward	Singapore
Age Distribution			
Over 65 yr %	12.4	18.4	8.4
15-64 yr %	73.9	69.8	72.0
0-14 yr %	13.7	11.9	19.7
HH Size	3.0	3.4*	3.6**
Foreign Workers %	7.5	3.5*	18.3

* Data in 2004

**Data in 2003

Table 8.3. Economic Structure: Hong Kong, Tokyo and Singapore, 2005

	Hong Kong	**Tokyo**	**Singapore**
GDP US$ Billion	177.7	760.3*	116.5
GDP per Capita	25,622	61,468*	26,833
GDP Annual Growth Rate %	7.0	0.9*	6.4
Economic Structure (Employment base)			
Unemployment Rate %	5.6	4.7	3.1
Import US$ Million	294,869	144,430**	214,962
Export US$ Million	284,832	136,983**	246,795
FDI US$ million			
Inward	568,853	103,674***	207,009
Outward	503,018	432,362***	116,451

* Tokyo Metropolitan Area

** 2004

***Entire Japan

The demographic make-up of the three city-regions also differs (Table 8.2). Among the three, Singapore has a more youthful population. Fueling Singapore's comparatively rapid population growth has been an influx of foreign workers (18.3% of Singapore's total population). By comparison, Tokyo has an older population profile and relatively few foreign workers (3.5% of workers). Hong Kong's demographic profile lies somewhere between that of Singapore and Tokyo with the exception of household size, which tends to be smaller – around 3 persons per household.

Economically, Tokyo is a far wealthier than either Hong Kong and Singapore (Table 8.3). In 2005, its per capita GDP was more than twice as high. However this is changing as reflected by the city's relatively tepid rate of income growth (0.9% annual increase). All three city-regions have strong tertiary (service-based) economies, which explain their high central-city densities (that confer agglomeration economies). Hong Kong and Singapore are more active in international trading than Tokyo. Foreign Direct Investments (FDIs) also vary. Tokyo's economy is oriented more to investing abroad whereas the opposite holds for Singapore and Hong Kong. Hong Kong accounts for far more foreign investment than either Tokyo or Singapore. Lastly, Hong Kong's joblessness rate is slightly higher than in the other two cities.

8.2 World-Class Railway Systems

High densities and healthy economic growth have sustained world-class railway systems in all three cities – and vice-versa (Table 8.4). Tokyo has the largest railway network among the three, however as revealed by Table 8.4, Hong Kong's railway density in its built-up urbanized area is exceptionally high (0.64 km per sq km). Compared to U.S. and many European cities, Hong Kong, Tokyo, and Singapore have spartan car ownership levels. Road space is also far more restricted in Hong Kong.

Table 8.4. Railway and Car-Roadway Systems: Hong Kong, Tokyo, and Singapore, 2005

	Hong Kong[1]	Tokyo GMA[2]	Singapore[3]
Railway: Length (one-way track km)	167.9	3,216.5	138.2
Density (track km per Sq km land area)	0.15 0.64[a]	0.24	0.20
# Stations	85	1,501	96
# of Operators	2	12	2
Types of Operators	Private (1) Public (1)	Private (8) Quasi-Private (1) Former Public (2) Public (1)	Private (2)
Roadway/Auto System: Road Density (one-way Km per Sq Km)	1.77	18.89[b]	4.50
Car Ownership Vehicle per 1000 people	51	263[c]	93

[1] MTRC & KCRC

[2] Eight Major Private Companies, Tsukuba Express(TX), Japan Railway East and Tokyo Metro, and Tokyo Municipal Subway. Some of the operators operate outside of Tokyo GMA.

[3] MRT+ LRT

[a] Urbanized Area

[b] FY2001

[c] FY2004

Tokyo

In 2005, a railway network of 3,216 directional km of track and 1,501 stations served a commutershed that expanded more than 100 km from the central Tokyo station. Tokyo's railway network – comprising a mix of railway lines of varying sizes owned by public, private and quasi-private operators – is, by far, the world's largest (Map 8.1 and Table 8.5). Encircling Tokyo's core area is the Yamanote line, with major terminals and high-rise office developments at or near the Tokyo-Marunouchi, Shibuya, Shinjuku, Shinagawa, Ikebukuro, and Ueno stations. Within the Yamanote loop is a dense network of both the now-privatized Tokyo Metro and publicly owned Eidan Subway services. Also crisscrossing central Tokyo are several lines of the privatized Japan Railway (JR) East (formerly the publicly owned Japan National Railway). Radiating outward from JR East's Yamanote loop is a thicket of privately built rail lines, plus JR East's heavy rail lines. Tokyo's private rail lines serve suburban areas and connect to major terminuses on the Yamanote loop, allowing passengers to switch to the Tokyo Metro or Eidan subway.

Tokyo's radial railway system supports and reinforces the region's monocentric structure. Converging rail lines and roadways have also translated into extreme congestion. Public transport ridership has been declining over the past 15 years in greater Tokyo, which has exacerbated central-city congestion to some degree.

Table 8.5. Major Railway Operators in the Tokyo Greater Metropolitan Area, 2005

Company/Agency	Type	Length km	# of Stations	Passenger km million	Year Opened
Tobu	Private	463.3	202	12,667	1897
Seibu	Private	176.6	92	8,669	1912
Keisei	Private	102.4	64	3,508	1909
Keio	Private	84.7	69	7,186	1910
Odakyu	Private	120.5	70	10,528	1923
Tokyu	Private	100.1	98	9,469	1922
Keikyu	Private	87.0	72	6,220	1898
Sotetsu	Private	35.9	25	2,604	1917
JR East	Former Public	1,698.3	516	76,694	1987 (1870)[a]
Tokyo Metro	Former Public	183.2	168	16,356	2004 (1927)[a]
Toei Subway	Public	106.2	105	5,291	1927
TX	Quasi-Private	58.3	20	NA	2005 (1991)[a]
Total		3,216.5	1,501	159,192	

[a] Years in parentheses denote year of opening as a public operator. Years not in parentheses denote year of transformation from a purely public operator.

Singapore

Singapore highly regarded rail services grew out of the 1971 Concept Plan. This visionary plan called for a new mass rapid transit system to serve as the island-nation's lifeline, linking residents of new housing estates to jobs, shopping centers, and recreational offerings throughout the island. In 1987, the east-west MRT line began service, followed by the opening of two north-south spurs in 1990. Together, they formed a 67-km, 42-station system completed two years ahead of schedule and under budget (US$2.2 billion). An additional 16 km of aerial line and 6 stations were added in 1996, linking the two north-south lines via a northern loop. Supplementing heavy rail (MRT) services are 56 kms of light rail (LRT) services with 48 stations plus an extensive bus network. A duopoly of SBS Transit and SMRT Corporation oversee and operate Singapore's

Map 8.1. Railway Network and Major Public, Private, and Quasi-private Operators in the Tokyo Great Metropolitan Area.

public transport network. Despite expansion of bus services, Singapore's rail network has been increasing its share of transit trips: since 1995, rail ridership has more than doubled and more recently begun to cut into the bus market (Figure 8.1). By 2012, Singapore's rail network is slated to expand by roughly 30% with the completion of Circle Line, Boon Lay Extension and Downtown Extension (Table 8.6 and Map 8.2).

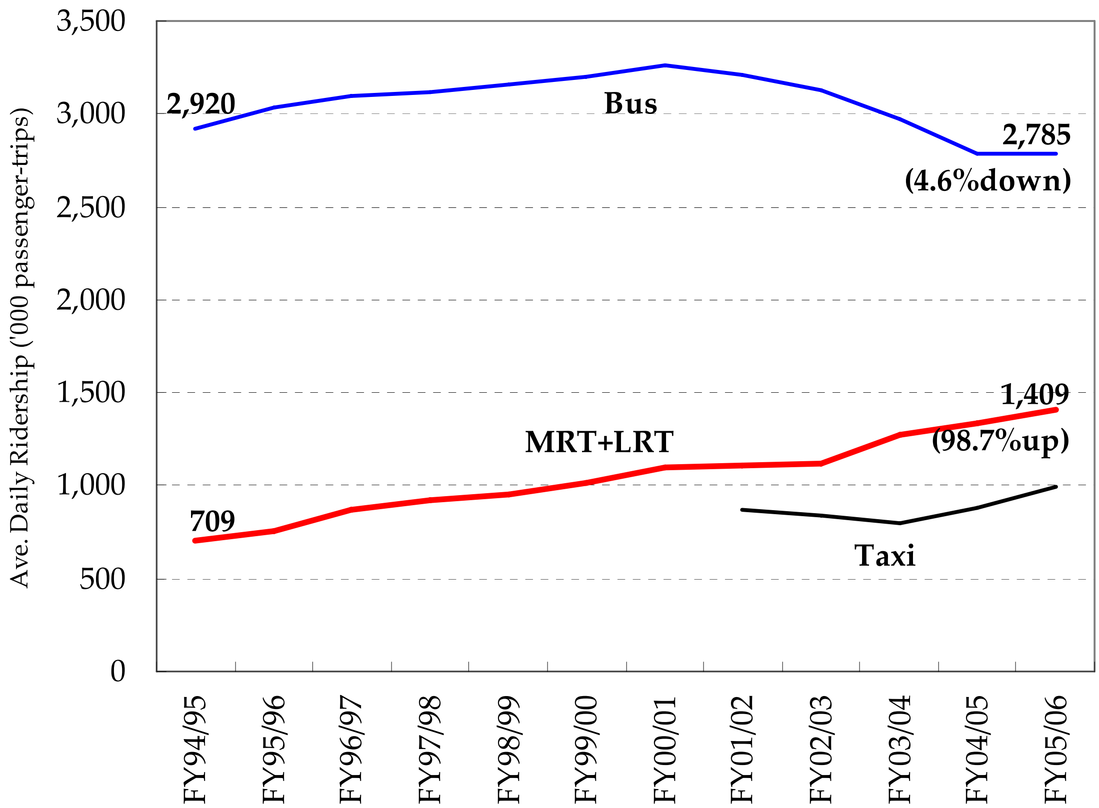


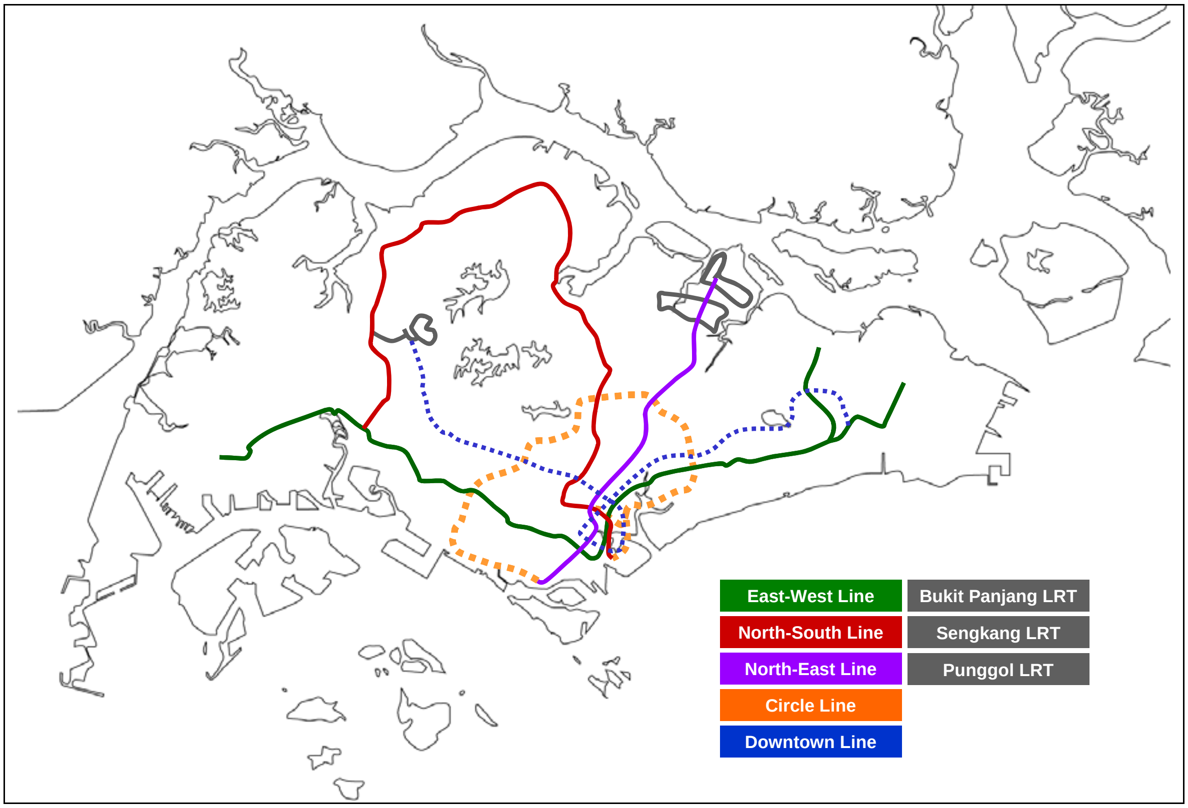
Figure 8.1. Ridership Changes for MRT and LRT Rail Services and Bus Lines: FY94/95 and FY05/06. Source: Singapore LTA, http://www.lta.gov.sg

Table 8.6. MRT and LRT Lines in Singapore

Line	Operator	Length Km	# of Station	Year Opened
East-West Line	SMRT	45.4	29	1987
North-South Line	SMRT	44	25	1987
North-East Line	SBS	20	15	2003
Downtown Line	-	40	33	2013-2018[a]
Circle Line	SMRT	33.3	29	2010-2011[a]
Bukit Panjang LRT	SMRT	7.8	14	1999
Sengkang LRT	SBS	10.7	11	2003
Punggol LRT	SBS	10.3	15	2005
Total[b]	-	138.2	96	-

[a] Projected dates of opening different segments of line.

[b] Only includes completed portions of the system. Because many stations service multiple lines, the station total is less than the sum of stations among the eight lines.



Map 8.2. MRT and LRT Network in Singapore

In Singapore, the vision of building a world-class public transport system has been complemented by restrictions on and high prices charged for automobile ownership and usage. Over the past three decades, Singapore officials have increasingly tightened the noose on the island's car population through a steady stream of automobile surtaxes, road-use surcharges, and a vehicle quota system in recognition of the nation's land constraints and to avoid the traffic gridlock. Singapore is the first place anywhere to introduce road pricing. Singapore's Area Licensing Scheme (ALS), introduced in 1975, was replaced in 1998 by Electronic Road Pricing (ERP). The ERP deducts charges from a stored-value in-vehicle debit card according to time of day and vehicle class. About 6 million transactions per day were made through ERP in 2003. In addition to ERP, Singapore's car ownership levels (91 car owners per 1,000 inhabitants in 2005) have been moderated through an electronic open-bidding system called the Vehicle Quota Scheme (VQS) that limits annual vehicle registrations. Supplemental charges for vehicle registration further increase the cost of owning a car. All motor vehicle tax proceeds go into a Consolidated Fund controlled by Singapore's central government. Thus unlike in the United States and many industrialized parts of the world, automobile-related revenues are not earmarked for highway projects but rather are combined with all revenues sources and distributed to multiple government sectors and projects, including housing and public transport.

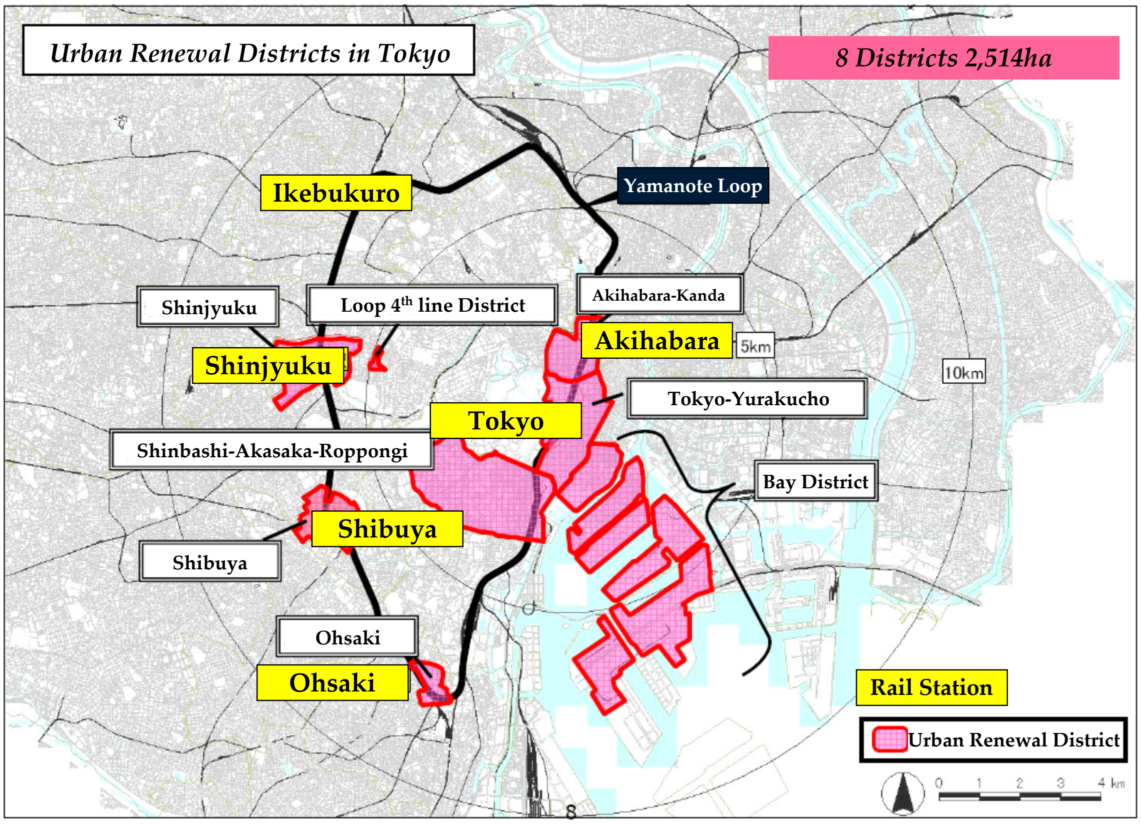
8.3 Development Strategies and Railways

As in Hong Kong, public policies have played a vital role in advancing transit-oriented development (TOD) in both greater Tokyo and Singapore. In the case of Tokyo, TOD principles are embodied in two recent initiatives: Japan National Government's *Urban Renewal* program and the Tokyo Metropolitan Government's *Master Plan*. Guiding TOD in Singapore in recent years have been the city-state's *Concept Plan 2001*, *the Master Plan 2003*, and several high-profile housing initiatives.

Tokyo

Japan's national urban renewal policy (*Toshi Saisei*) has noticeably altered Tokyo's cityscape in recent years. The *Urban Renewal Law of 2002* was enacted to create urban-oriented projects that increase economic productivity and global competitiveness with emphasis given to improving public infrastructure, relaxing land-use regulations, and leveraging private investment through public grants. In central Tokyo, 2,514 ha of land located in 8 districts has been slated for large-scale private-based redevelopment, including high-rise, mixed-use projects near major railway stations on the JR Yamanote Loop (such as Shinjuku, Shibuya, Tokyo-Marunouchi, and Akihabara) (Figure 8.2).

National urban renewal policies have been complemented by rail-oriented decentralization policies at the local level. To alleviate central-city congestion, the Tokyo Metropolitan Government has sought to transform Tokyo from a monocentric to a more polycentric urban structure. Tokyo Metropolitan Government's 2001 master plan, called "Megalopolis Belt Structure" (*Kanjo Megalopolis Kouzou*), envisages a future city-region comprised of a five distinct districts: (i) center core; (ii) bay waterfront belt; (iii) living environment belt; (iv) outer core interaction belt; and (v) natural environment belt (Figure 8.3). The plan identifies a multi-modal transportation network (comprising railways, roadways, and airports) as the chief mechanism for steering growth into these designated areas.



Metropolitan Government/ Prefecture	# of District	Area ha	Municipalities
Tokyo	8	2,514	
Kanagawa	11	615	Yokohama, Kawasaki, Sagamihara, Fujisawa, Atsugi
Saitama	2	115	
Chiba	4	185	Chiba, Kashiwa
Total	25	3,429	

Figure 8.2. Japan National Government's Eight Urban Renewal Districts and Major Terminal Stations in Tokyo. Source: the Japan National Government, the Urban Renewal Office

In the center core zone, several large-scale redevelopment projects are underway that take advantage of Tokyo's highly developed subway. However in a break from tradition, what in the past would have been exclusively office-commercial projects today also feature professional-class, high-end housing and consumer services. The real-estate market around several central-city stations, notably Akihabara, Tokyo, Shinjuku, and Shinagawa, have been abuzz with activity in recent years, becoming 24-hour, 7-days-a-week places (Figure 8.4).

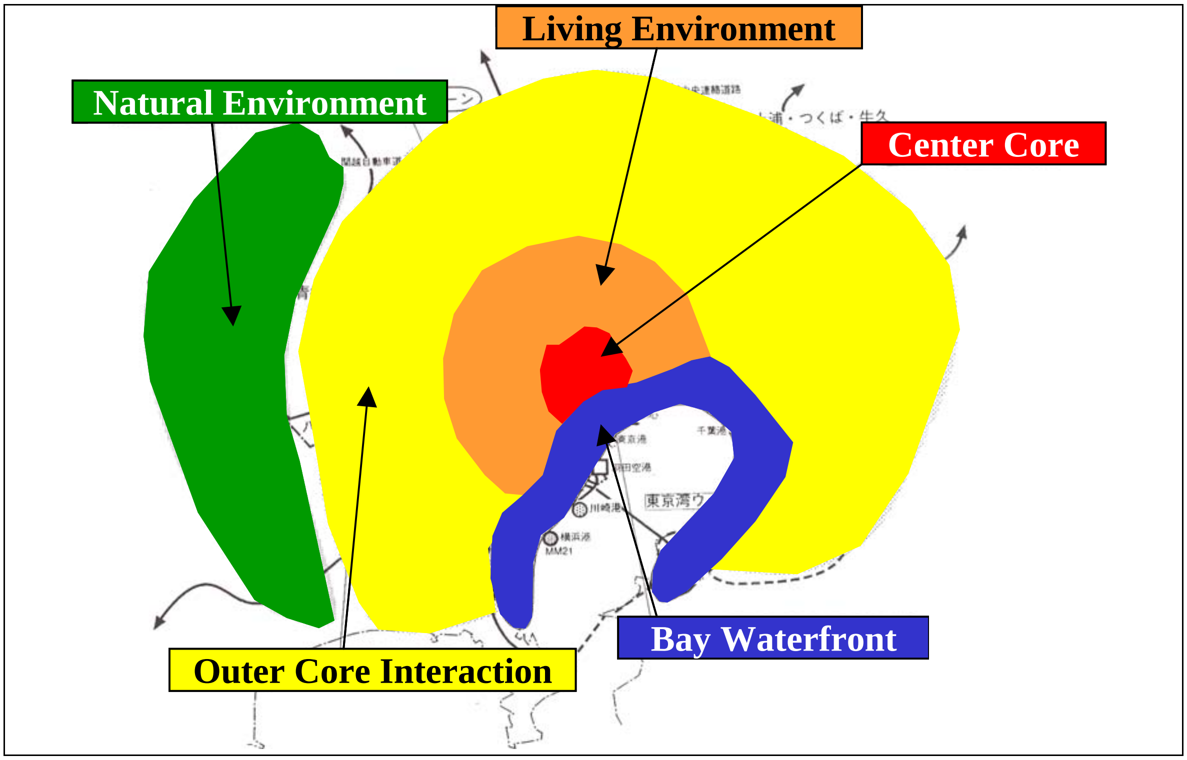


Figure 8.3. Five Planning Zones in Tokyo's "Megapolitan Belt Structure"
Source: Tokyo Metropolitan Government 2001

Figure 8.4. Planning Areas and Terminal Station Redevelopments in the Center Core. Source: Tokyo Metropolitan Government 2001

In the “living environment” belt that rings the core, mixed-use TOD is also planned. However, the station-area land markets in this district are not as strong as in the center core. Also, land assembly for station redevelopment outside the urban core can be costly due to fragmented property ownership and less central-government aid for redevelopment. Futako-tamagawa is one of the few large-scale projects in the “living environment” zone that is taking advantage of railway proximity and showing signs of economic vitality (Figure 8.5).

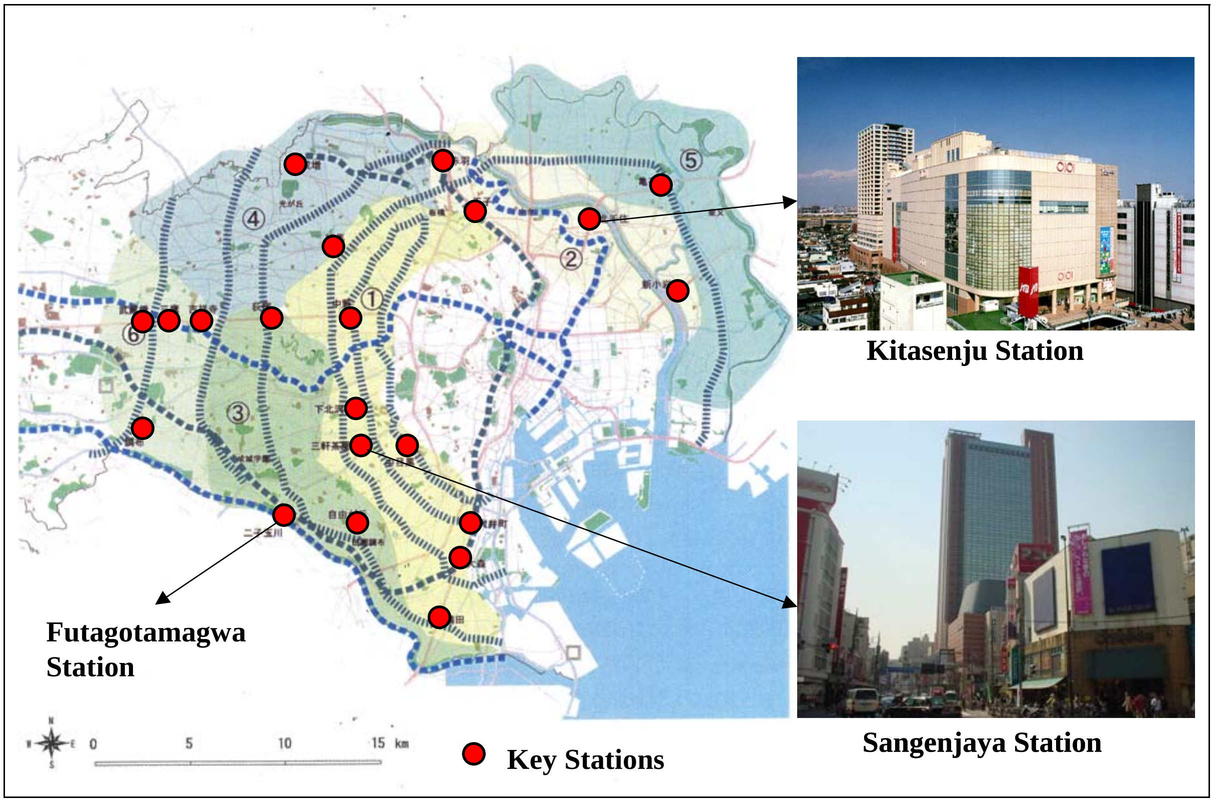


Figure 8.5. Station Redevelopments in the Built Environment Belt
Source: Tokyo Metropolitan Government 2001

In the “outer core interaction” belt, university parks, research institutes, high-tech manufacturing, and IT industries are being built. Most are oriented toward expressway interchanges. However, one or more rail lines also serve a number of new high-tech developments, giving rise to a more clustered, mixed-use form than typically found with high-tech industries. While a beltway (*Kenohdou*) is being constructed within the outer core interaction belt, so is Tsukuba Express (TX), which spans across Tokyo’s eastern side. Minamimachida station is an example of a large-scale, mixed-use project in the interaction belt that has both a transit-oriented and auto-oriented design (Figure 8.6).

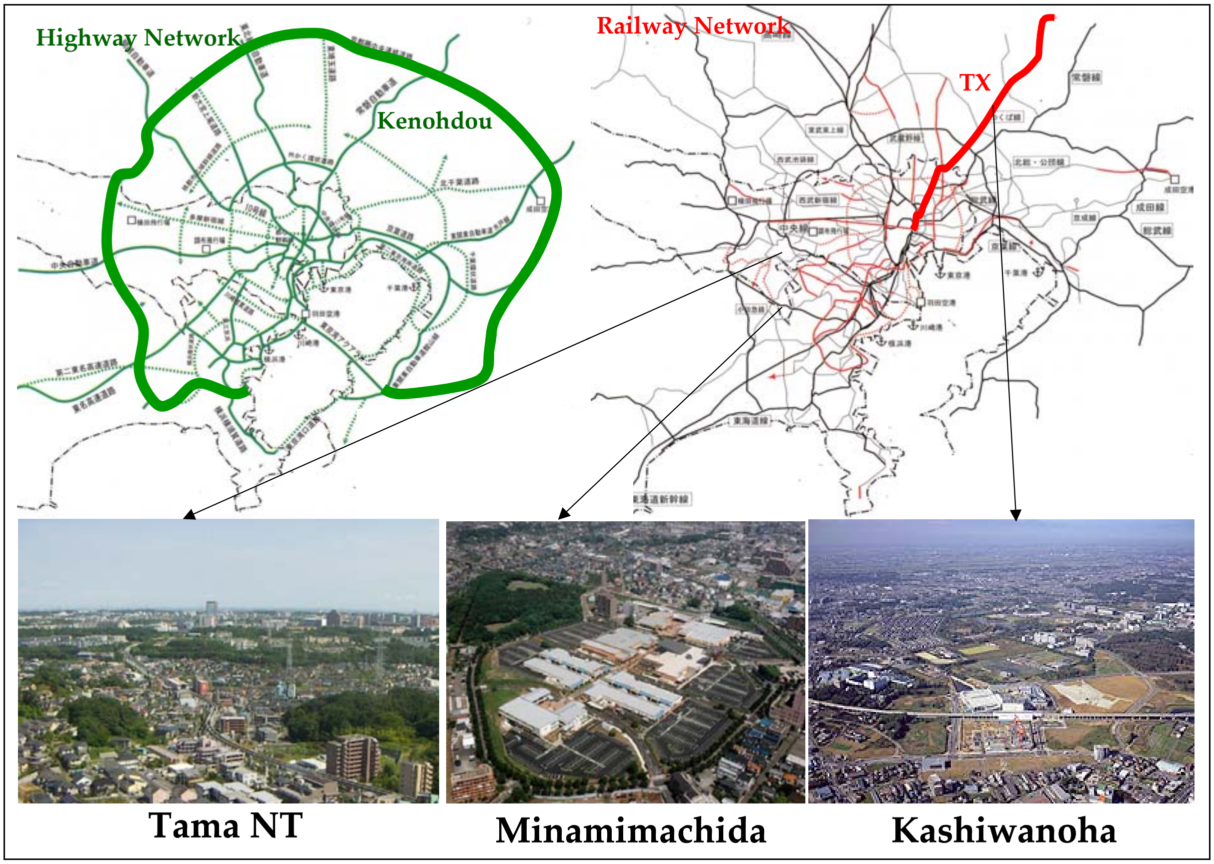


Figure 8.6. Projected Highway and Railway Networks and Station Developments in the Outer Core Interaction Belt.
Source: Tokyo Metropolitan Government 2001

<u>Singapore</u>

The Urban Redevelopment Authority (URA), an arm of Singapore's central government, has assumed the major responsibility for planning and guiding urban development in the territory under the guise of a long-term strategic plan (*Concept Plan 2001*) and a medium-term implementation plan (*Master Plan 2003)*.[2] The *Concept Plan 2001* projects a total of 5.5 million inhabitants some 50 years into the future within the island-state's limited geographic territory (Figure 8.7). So that Singapore remains competitive in the global marketplace, the plan seeks to lure high value-added businesses and investors to the island-state by creating

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[2] Singapore's *Master Plan 2003* adds specificity to the longer-range strategic plan for purposes of guiding development over the next 10 to 15 years. It is reviewed every five years, and translates longer term strategies into detailed implementation projects. It also specifies permissible land uses and density conditions on every land parcel in Singapore.

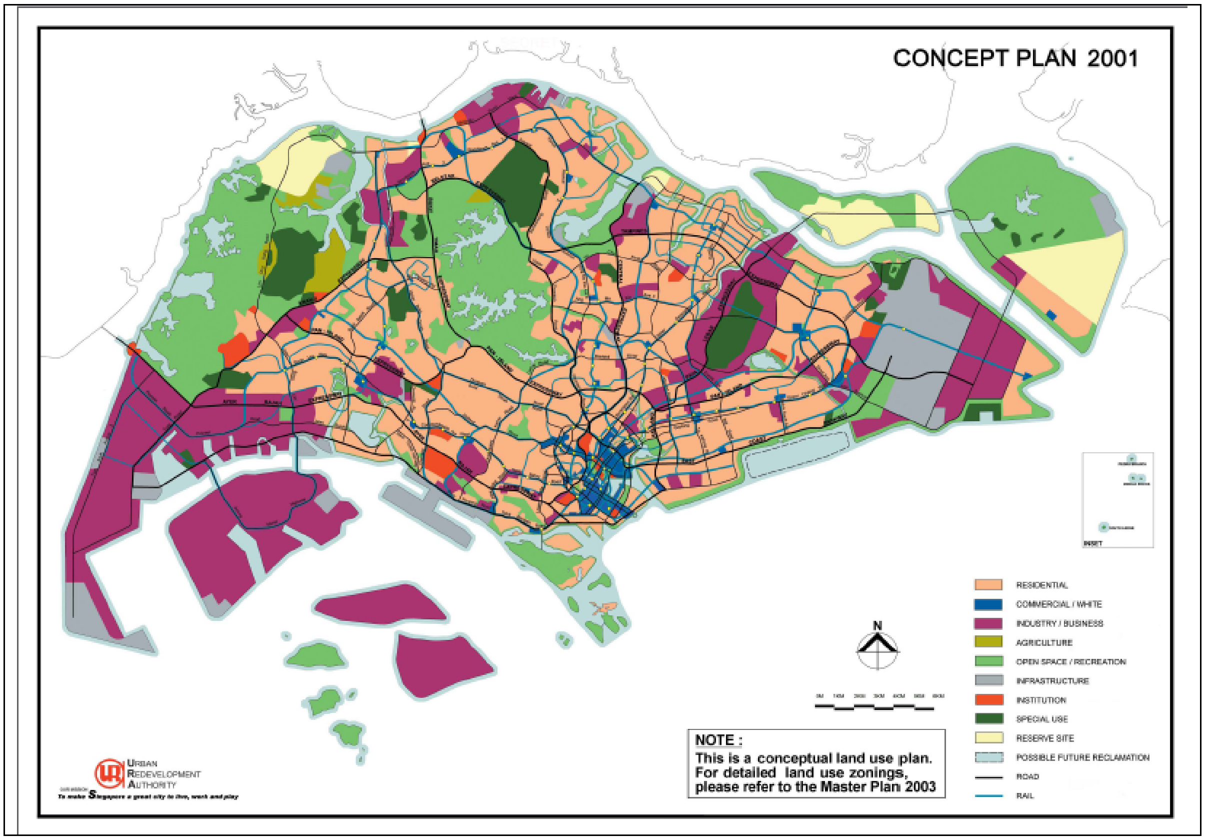
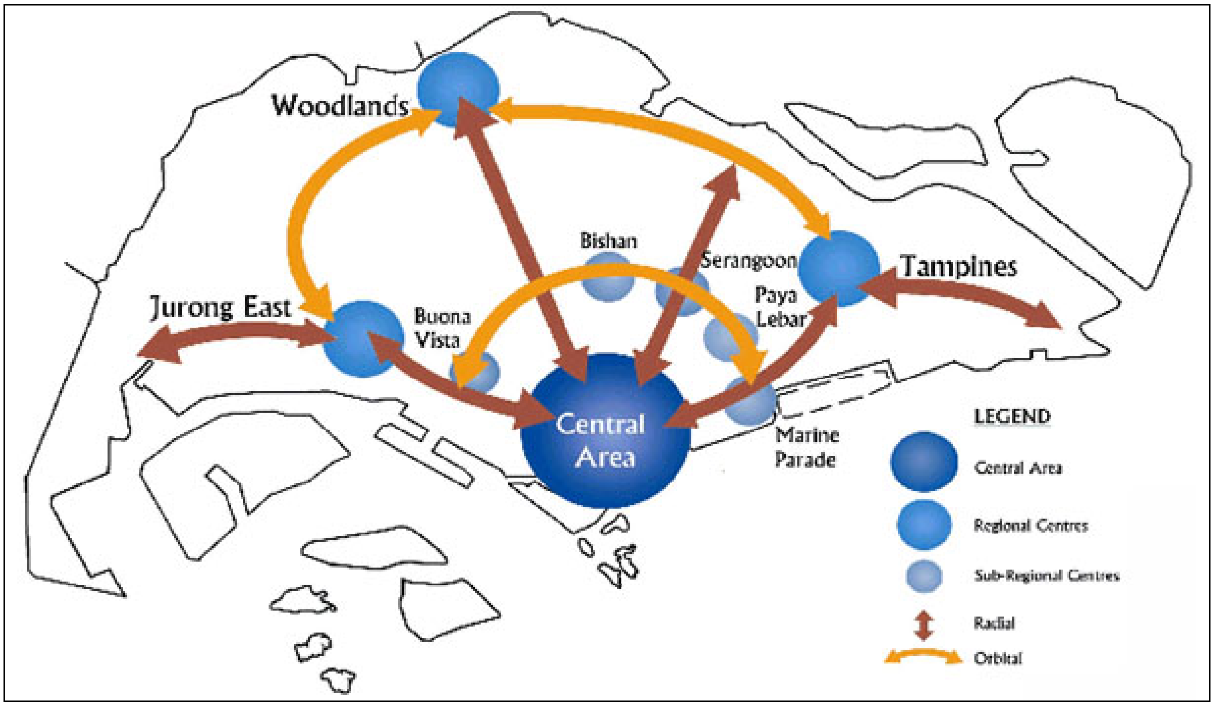


Figure 8.7. Singapore's Concept Plan 2001
Source: Singapore Urban Redevelopment Authority (URA)

high-quality living environments, preserving natural habitats, and building world-class transport infrastructure.

As Singapore's economy becomes increasingly oriented to knowledge-based global services, most finance, information, and business service sectors are locating in the city's Central Area. To support urban agglomerations as well as back-office activities in sub-centers, a dense MRT+LRT network is envisaged. The *Concept Plan 2001* calls for some 500 kms of future radial and ring railway services that link outlying and core areas in addition to accommodating cross-island travel that bypasses the core (Figure 8.8). Three regional centres – Tampines, Woodlands, and Jurong East – are connected to the core via the MRT+LRT network. The Concept Plan gives particular attention to linking jobs and housing via rail transit. As more jobs are created in the North, North-East and East sub-regions, more residential neighborhoods are and will be developed within walkable catchments of MTR and LRT stations, particularly in the western part of the city.



8.8. Long-Range Rail Network Plan and City Structure – the "Constellation" Plan. Source: Singapore Urban Redevelopment Authority (URA) Concept Plan 2001

Most of Singapore's new-town housing developments predate yet anticipated the MRT+LRT network (Figure 8.9). In Singapore, new towns and high-quality rail transit have been co-dependent. Indeed, new-town housing construction peaked in the 1980s when the MRT was being planned and built (Figure 8.10). By 2007, Singapore's Housing and Development Board (HDB) had built some 872,000 flats that were home to nearly 3 million residents (or 81% of total population). Almost all of this housing was sited along MRT corridors. At build-out, some 1.4 million dwelling units will have been constructed in 24 new towns. Critical to linking peripheral new towns is the 33km, 29-station MRT Circle Line that will connect four sub-regional centers: Bishan; Buona Vista; Serangoon; and Paya Lebar (Figure 8.11).

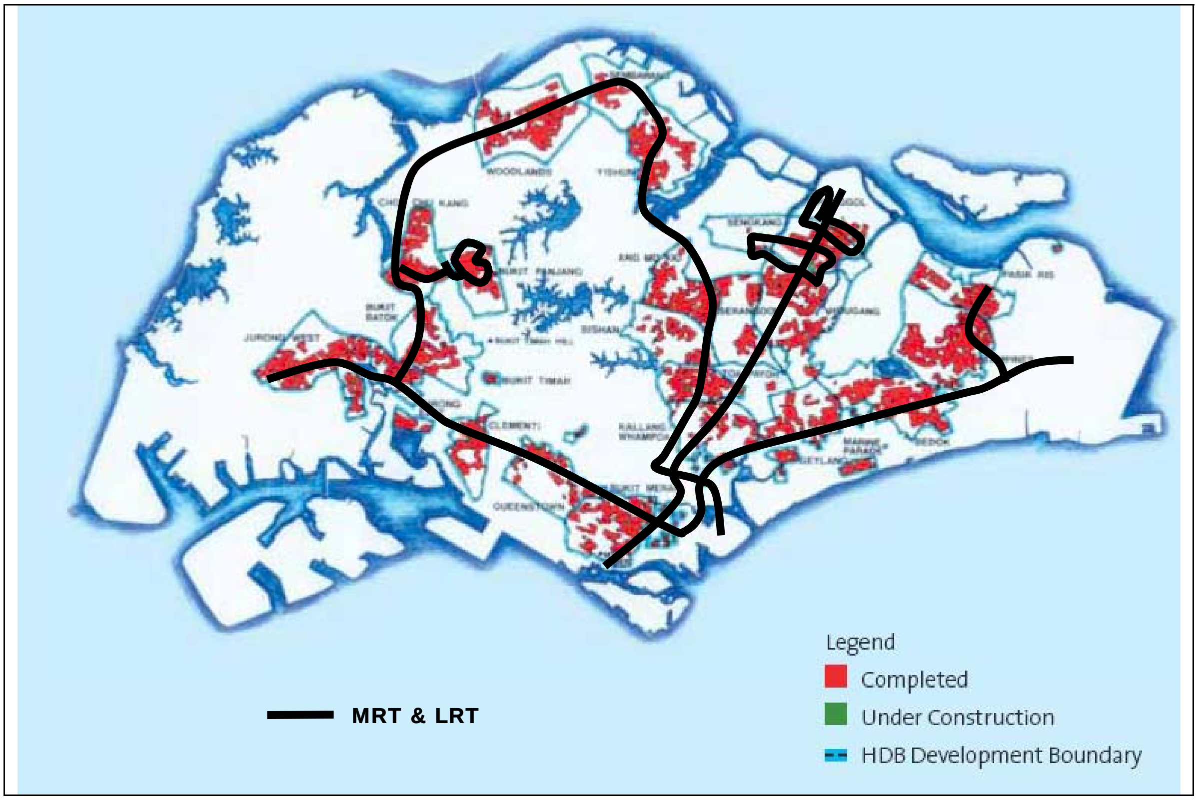


Figure 8.9. New Town Housing Developments (24 Towns; 871,813 flats; 2,980,600 residents; 7,435ha) and MRT+LRT network in FY 2006/2007.
Source: Housing and Development Board (HDB)

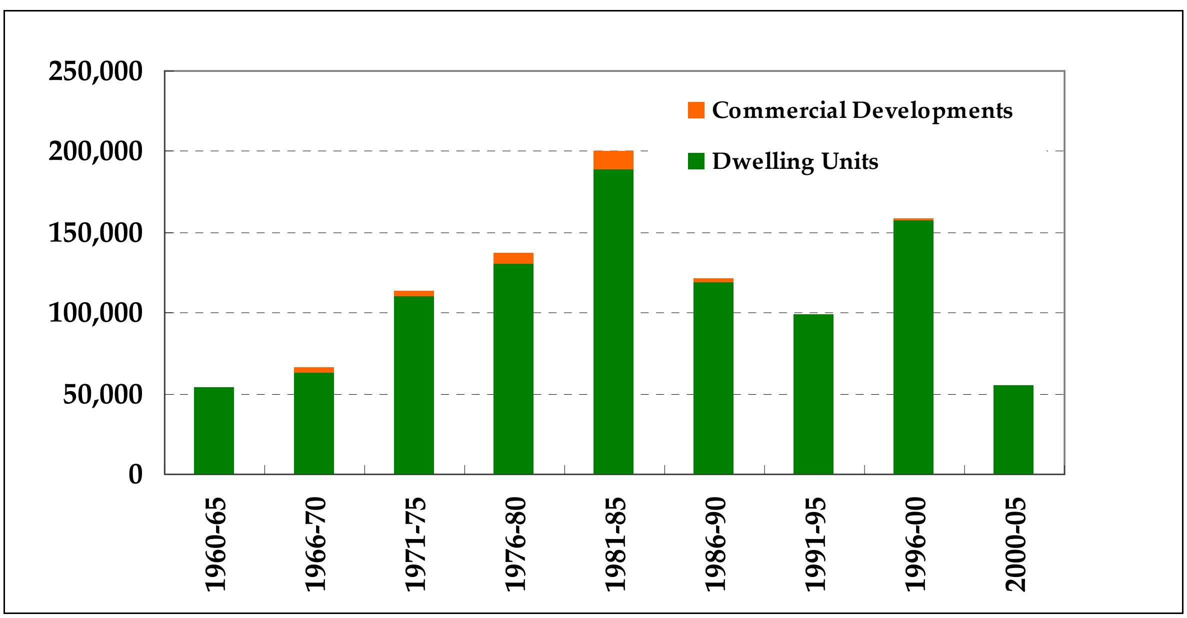


Figure 8.10. HDB's Dwelling Units and Commercial Developments since 1960
Source: Housing and Development Board (HDB)

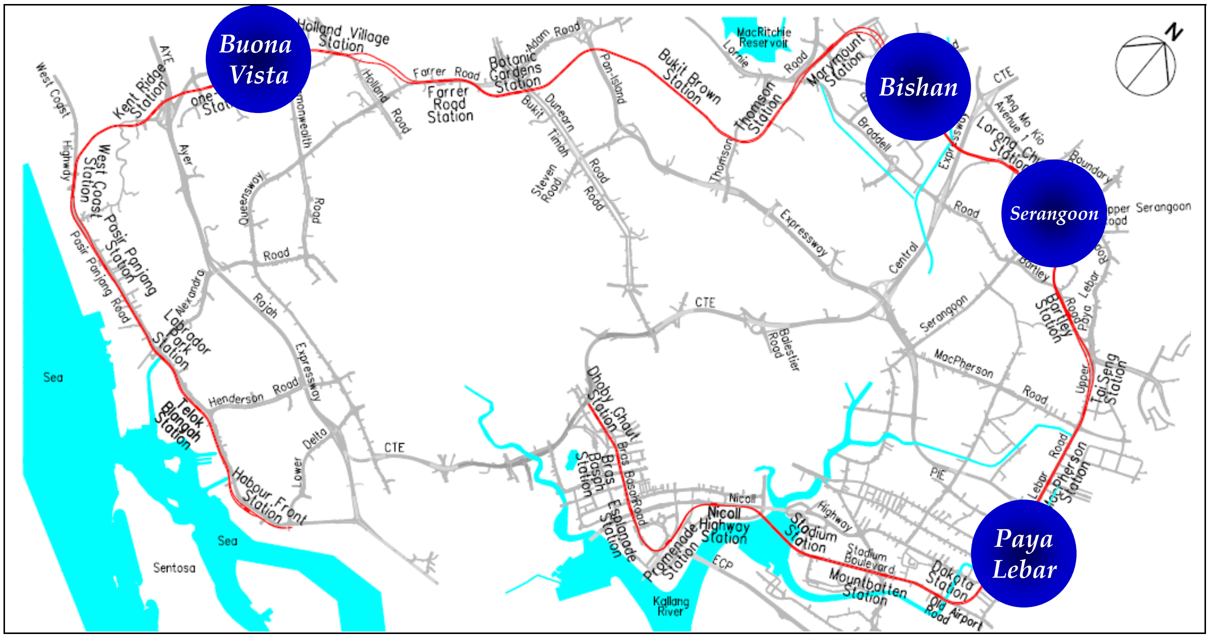


Figure 8.11.0 Four Sub-Regional Centers and MRT Circle Line Development by 2010. Source: Land Transport Authority (LTA)

8.4 Railway Finance and Performance

Given the focus of this study on MTRC's R+P programme as a form of transit finance, we now turn to the question of how railway investments have been funded in the two comparison city-regions as well as the overall financial performance of these investments. As discussed below, Tokyo and Singapore have adopted markedly different approaches to paying for railway infrastructure.

Tokyo

Greater Tokyo has a long tradition of private financing of suburban railway development through capturing land value increases created by improving accessibility via public transit. This has historically occurred through a public-private partnership wherein Tokyo's metropolitan government granted exclusive franchises to private railway conglomerates so as to transfer the financial burden to the private sector but also to create a close nexus of railway investments and new-town development.[3]

[3] R. Cervero, *The Transit Metropolis*, Washington, D.C., Island Press, 1998.

Financial Performance

Like Hong Kong's MTRC, Tokyo's railway companies have historically leveraged real-estate development to both pay for infrastructure and produce a profit for share-holders. Moreover, they have similarly developed ancillary projects like in-station convenience shopping and integrated shopping malls. During the 1980s at the height of railway/new-town co-development, railway companies were earning investment returns on ancillary real estate projects in the range of 50% to 70% (Cervero, 1998).

Tokyu Corporation is greater Tokyo's largest private railway company and was among the first to advance the business model of railway/new-town co-development. Table 8.7 as well as Figures 8.12 and 8.13 show that in Fiscal Year 2006 around 10% of Tokyu Corporation's revenues came from real-estate projects which when matched with costs yielded more than a 20% rate of return. Real-estate projects generated even higher shares of revenues and higher rates of return among most of Tokyo's other private railway companies, all of whose railway networks are smaller than Tokyu Corporation's. For all eight private railways, returns from real estate exceeded companies' overall profit margins.

Even more noticeable is the substantial financial role that real-estate development plays for Tokyo's two former public railways, JR East and Tokyo Metro. In the case of JR East, the serious fiscal crisis faced by the former Japan National Railway (with an accumulated debt of US$300 billion) led to privatization in 1987. Among other changes that occurred, JR East was given by the national government large developable land parcels around terminal stations that could be transformed into profitable commercial ventures. In FY 2006, real-estate yielded more than 40% returns on investment for both former public railways, albeit Tokyo Metro has not aggressively pursued large-scale development, relying instead on farebox returns to cover costs. Similarly, the publicly owned and operated metro system, Toei Subway, relies mainly on transportation income (which in its case, failed to cover costs in FY 2006).

In fiscal year 2006, the poorest financial performer among all railway entities was the Tsukuba Express, a quasi-private railway company that opened in 2005. Although it now incurs deficits, Tsukuba Express is expected to run in the black in coming years owing to large-scale redevelopment that occurring along its corridors.

Table 8.7. Financial Performance of Major Railway Owner-Operators in the Tokyo Great Metropolitan Area, FY2006

Owner Operator	Type	Revenues				Return (Revenues/ Expenses) %			
		Total Yen Million	Transport %	Real Estate %	Others %	Total %	Transport %	Real Estate %	Others %
Tokyu (TK)	Private	1,457.6	13.2	10.4	76.4	5.8	15.4	20.7	2.6
Tobu (TB)		701.1	30.7	10.4	59.0	7.9	16.4	15.2	2.8
Odakyu (OK)		692.4	24.2	11.2	64.6	7.8	18.6	21.6	2.3
Keio (KO)		477.2	27.3	5.7	67.0	10.0	17.9	55.3	4.5
Keikyu (KK)		381.6	30.6	12.6	56.8	10.4	20.1	21.1	3.8
Sotetsu (ST)		328.8	12.9	23.3	63.8	7.8	23.6	22.2	0.9
Keisei (KS)		259.8	43.3	8.3	48.4	9.9	17.8	22.2	2.1
Seibu (SB)		208.7	48.2	17.7	34.2	14.1	23.0	39.4	-4.6
JR East (JRE)	Former Public	1,662.8	50.0	11.9	38.2	34.7	62.3	42.3	8.8
Tokyo Metro (TM)		330.7	96.8	3.2	0.0	36.6	36.4	43.8	NA
Toei Subway (TS)	Public	182.6	99.5	0.0	0.5	-1.2	-1.3	NA	9.2
Tsukuba Express (TX)	Quasi Private	26.8	100.0	0.0	0.0	-8.6	-8.6	NA	NA

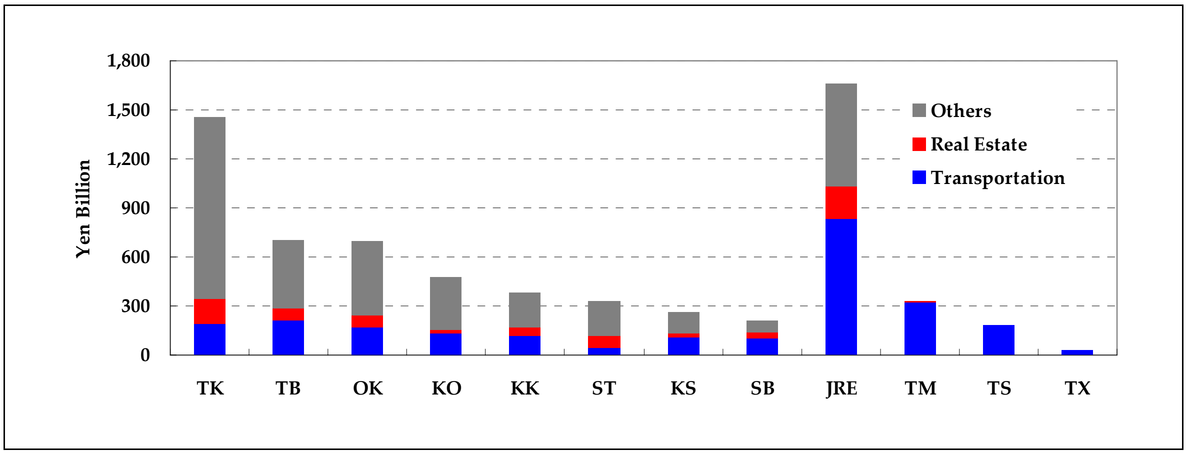


Figure 8.12. Revenue Structure of Major Railway Companies in the Tokyo Great Metropolitan Area, FY2006

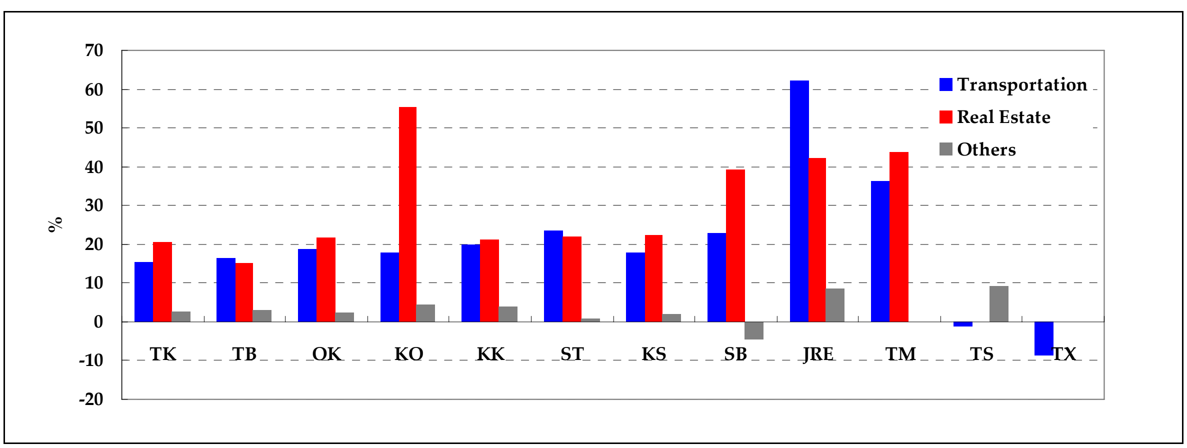


Figure 8.13. Rates of Return (Revenues/Expenses) Among Major Railway Companies in the Tokyo Great Metropolitan Area, FY2006

Figures 8.14 and 8.15 provide further breakdowns of revenue sources of Tokyu Corporation and the privatized JR East, respectively. In Tokyu's case, retail activities in and around railway stations has been increasingly turned to as a source of income. While construction (the major activity of the "other" category) was the biggest revenue generator in 2000, today its income role is modest. Similarly real-estate income has flattened. This is in large part because as an older company, Tokyu Corporation has already tapped into many of the real-estate and construction possibilities of its landholdings. In a region with fairly modest population growth albeit rising incomes, Tokyu Corporation has found more profit in ancillary retail than station-area development in recent years.

In JR East's case, Figure 8.15 shows that non-transport revenues have gradually risen since privatization. Unlike Tokyu Corporation and other private railway companies, JR East has shied away from housing construction, focusing instead on retail and office development on, above, and near its terminal stations.

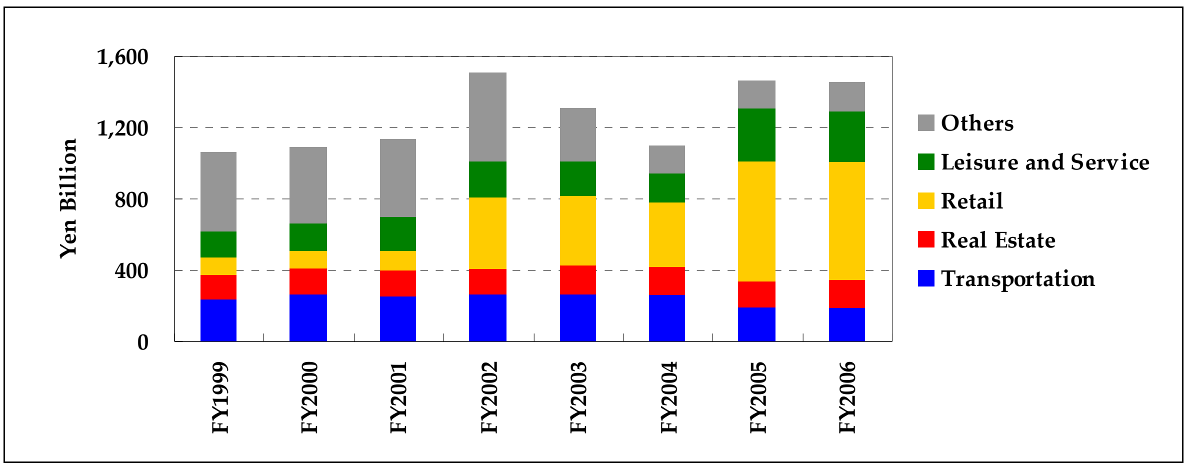


Figure 8.14. Tokyu Corporation (TK) Revenue Structure, FY1999-FY2006
Source: Tokyo Corporation Annual Reports

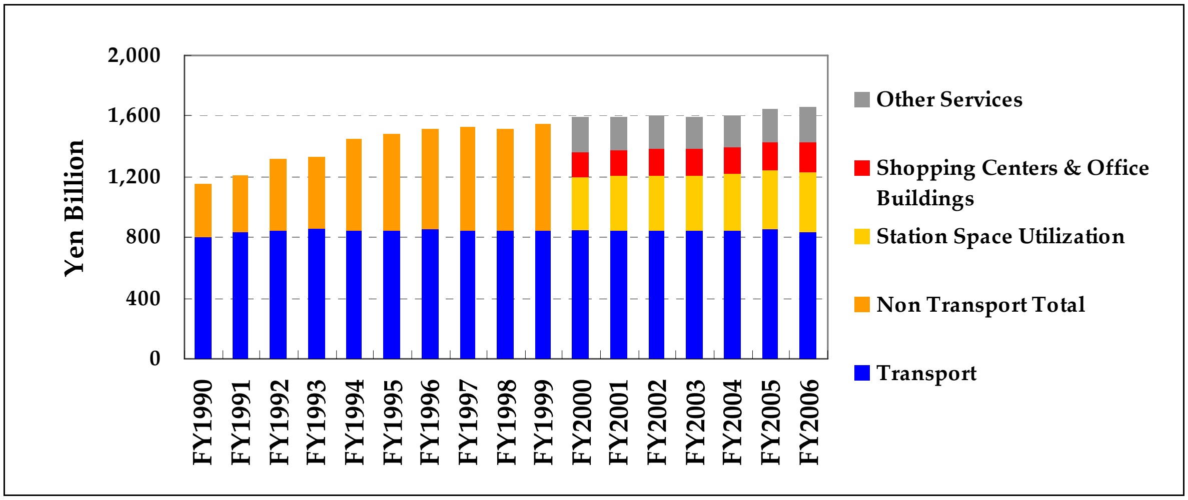


Figure 8.15. JR East (JRE) Revenue Structure, FY1990-FY2006

Source: JR East Fact Sheet

Railway Infrastructure Financing Methods

As outlined in the prior section, Tokyo's private railway companies have historically financed railway investments and extensions using the value capture model. However rising construction costs and a shrinking supply of low-cost agricultural land from which to capture value through TOD have forced many to turn to other funding sources in recent years. In fiscal year 2005, almost all of the US$2.67 billion invested in railways went to projects that increased capacity, enhanced safety, or upgraded services (notably track elevation projects) as opposed to new line construction. In addition to equity savings, private railway companies relied on a combination of farebox revenues, government grants, and borrowing to pay for new investments. Between fiscal years 1999 and 2005, low-interest loans underwritten by the Development Bank of Japan have covered 43% to 48% of railway investment costs with the remainder coming from private railway companies' own sources.[4] In recent years, the responsibility for new railway lines has abruptly shifted to the public sector, with private operators focused on aligning their operations to run on new lines as efficiently and seamlessly as possible.

[4] Japan's Development Bank is backed by national trust funds (Zaito), however plans to privatize the Bank in 2008 will likely result in a shift to private financial funding of private-based urban projects in coming years. Self-financed portions of capital investments are often underwritten by government bonds sponsored by state-owned enterprises as well as other government programs that incentivize private infrastructure investment.

Singapore

Singapore's government has created a duopoly to operate mainline public transport services. In contrast to Tokyo, however, Singapore's government owns the entire MRT+LRT network. Two private operators – SMRT Corporation and SBS Transit – operate passenger services under 50-year concessions. These "backbone" services are fed by neighborhood-level buses and private taxis. Figure 8.16 shows the sources of income for each transit operator in fiscal year 2006. Unlike Hong Kong and Tokyo, Singapore's operators have not pursued real-estate ventures. Rather, land development is the province of two other authorities, as discussed later.

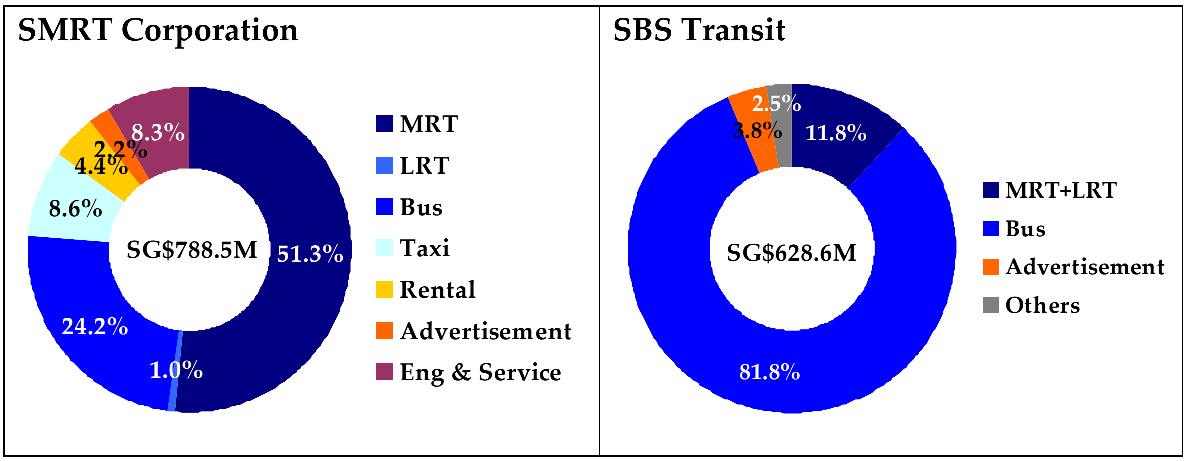


Figure 8.16. SMRT Corporation and SBS Transit: Revenue Structures in FY2006

SMRT Corporation

Singapore's largest railway operator, SMRT, has relied principally upon farebox receipts and other revenues (like advertizing) to cover operating costs. Table 8.8 shows the corporation has enjoyed rising rates of return in recent years. These figures, however, only present the on-going expenses of operating and maintaining the services and do not include capital depreciation and debt service. Singapore's central government shoulders the burden of railway infrastructure costs, using other (non-transit) income to cover these outlays.

SMRT Corporation's LRT system has failed to cover its operating costs although its financial performance has improved more recently. Because of regulated tariffs, the financial performance of bus and taxi services has deteriorated in recent years with government transfers used to make up losses. SMRT Corporation's rental and advertising businesses are small income generators but yield high rates of return due to the high volume of pedestrian traffic around MRT station.

SBS Transit

Singapore's other operator, SBS Transit, has consistently covered operating costs and generated a net profit of around 10% in recent years (Table 8.9). (Since SBS Transit's operating costs are consolidated across all modes, only total revenue/cost ratios are available.) Even though SBS Transit's MRT+LRT lines were opened only recently (in 2003 and 2005), they have produced steadily rising revenues.

Table 8.8. SMRT Corporation Revenue Structure and Return (Revenue/Expense) FY2001-FY2006. Source: SMRT Corporation

	FY01	FY02	FY03	FY04	FY05	FY06
Revenue, *SG$ Million*						
MRT	375.0	384.4	366.1	366.3	381.0	404.4
LRT	8.4	7.8	7.5	7.6	7.8	8.1
Bus	57.1	185.3	185.4	185.1	185.0	190.7
Taxi	20.2	60.5	57.7	70.3	79.3	68.1
Rental	29.6	30.7	20.6	20.5	26.2	34.6
Advertising	-	-	10.8	10.7	13.0	17.0
Eng. & Service	6.6	17.0	61.5	64.2	60.0	65.7
Total	496.8	685.6	709.6	724.7	752.3	788.5
Return (Revenue/ Expense), %						
MRT	120.5	118.7	119.4	120.2	132.5	134.4
LRT	81.9	71.9	63.5	76.3	91.7	89.3
Bus	112.3	107.2	108.1	106.2	105.7	103.0
Taxi	119.2	112.1	105.4	106.9	101.9	93.0
Rental	851.3	892.5	627.3	557.3	498.6	367.1
Advertising	-	-	283.4	278.5	276.6	285.1
Eng. & Service	154.5	131.8	117.9	112.5	104.2	106.1
Total	125.1	118.3	116.6	117.0	122.0	122.1

Table 8.9. SBS Transit Revenue Structure (SG$ Million) and Return (Revenue/Expense) FY2001-FY2006. Source: SBS Transit.

	FY04	FY05	FY06
MRT+LRT	55.6	63.9	74.5
Bus	485.6	493.2	513.9
Advertisement	18.4	19.2	24.2
Others	12.9	14.0	16.0
Total Revenue, *SG$ million*	572.5	590.3	628.6
Return (Revenue/Expense) %	110.1	110.7	110.1

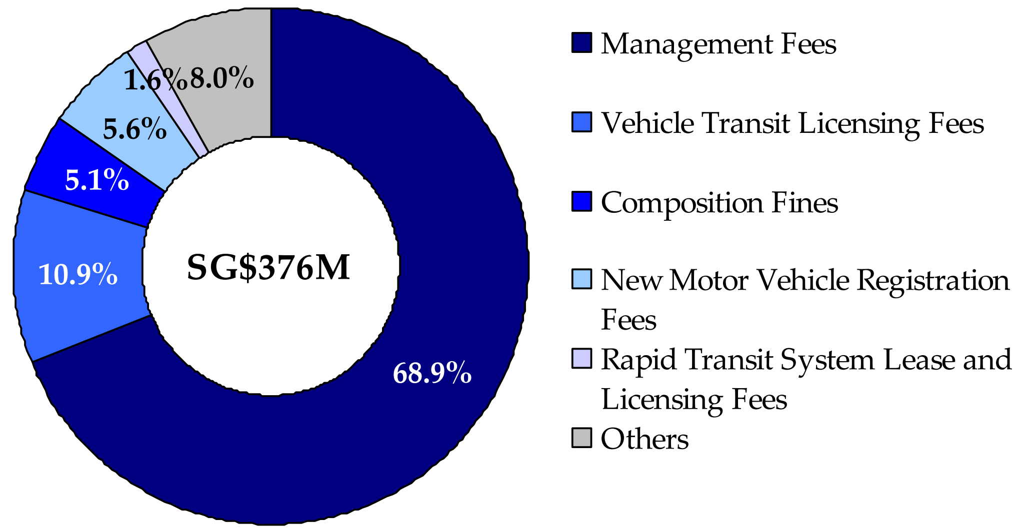
Land Transport Authority (LTA): Automobile-related Operating Revenues and Government Grants

The planning, design, construction, management and upkeep of Singapore's MRT and LRT systems are overseen by Singapore's Land Transport Authority (LTA). The authority is also responsible for roads. In fiscal year 2005/2006, most of LTA's income came from management fees (Figure 8.17).[5] Over one-fifth of revenues came from automobile-related charges, notably fees for vehicle licensing and new motor vehicle registration.

Due to the high cost of railway investments, particularly subways, even with income from roads and automobile users, LTA does not generate enough income to cover all costs. The authority's overall deficit has gradually been increasing over the past five years. Government transfer payments (from the consolidated fund of the central treasury) and external borrowings, in the form of unsecured bonds, have made up the difference. In fiscal year 2005/2006, LTA made a small contribution to government's consolidated fund (SG$11 million) however what it got back from the central treasury (SG $315 million) was much larger. In Singapore, LTA receives among the largest transfer payments from the central fund, reflecting government's commitment to build world-class infrastructure.

[5] Management fees are money paid by the Ministry of Transport to LTA for services rendered in planning, operating, maintaining, and monitoring the land transport system.

Operating Income



Total Revenue	*SG$ (millions)* 376
Operating Expenditure (includes bond interest and depreciation)	709
Operating Deficit	**-333**
Non Operating Surplus	18
Net Deficit Before Government Grants	**-315**
Government Grants	371
Contribution to Consolidated Fund	-11
Net Surplus	**45**

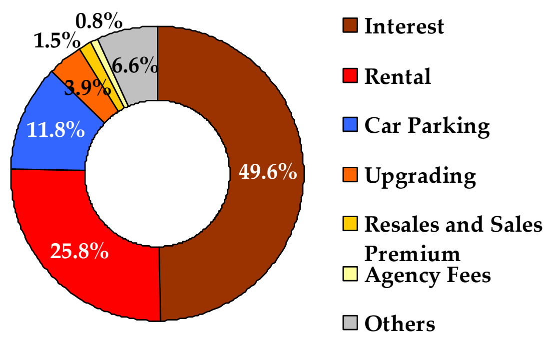
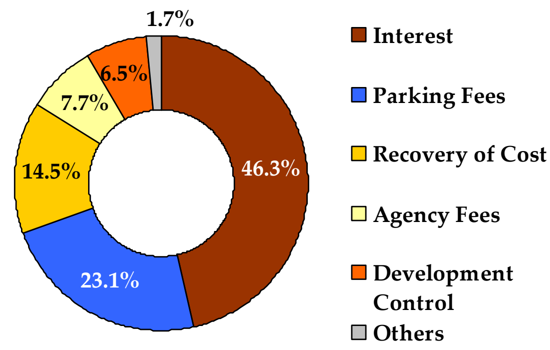
Figure 8.17. Singapore LTA: Operating Revenue and Expense (SG Million) in FY2005/2006

Housing & Development Board (HDB) and Urban Redevelopment Authority (URA)

HDB and URA are the two government entities involved with large-scale property development and charged with implementing the island-state's transit-oriented Concept and Master Plans. In this sense, their property-development roles most closely parallel those of Hong Kong's MTRC R+P programme and Tokyo's private railways.

In fiscal year 2005/2006, HDB's primary sources of income came from investment interest, property rentals, and car parking fees (ignoring profits from land sales) (Figure 8.18). Still the Board's operating and capital expenditures exceeded

Table 8.18. HDB and URD Financial Performances, FY2005/2006

HDB		URA	
Income 	SG$ Million 3,089	Income 	SG$ Million 226
Profit from Land Sales	137	Profit from Land Sales	3,127
Net Income*	**3,226**	Net Income**	226
Operating Expenditure	4,703	Operating Expenditure	117
Capital Expenditure	1,131	Capital Expenditure	2
Deficit	**-2,608**	**Surplus**	**107**
Net Income/Total Expenditure %	**55.3**	**Net Income/Total Expenditure %**	**189.9**
Government Grant	**755**	**Contribution to Consolidated Fund**	**-22**

Source: Singapore HDB and URA. *Including the Profit from Land Sales.
**Excluding the Profit from Land Sales

revenues, requiring transfer payments from the central treasury to make up the difference. Compared to HDB, URA's revenue intake was fairly modest in FY 2005/2006, coming mainly from investment interests, car parking fees, and recovery of development cost. However URA's profits from land sales were enormous. Not even counting this income, URA still netted a surplus. In FY 2005/2006, HDB was a donee agency, heavily reliant on government assistance while URA was a donor agency, making a SG$22 million contribution to the government's consolidated fund.

One of the most important missions of both HDB and URA is implementing the *Government Land Sales (GLS)* programmes, in which developments rights of land parcels are sold through pubic auctions on the basis of property type, building height, and plot ratio requirements. The SG$3.127 billion URA secured from land sales in FY 2005/2006 came from selling property development rights in the bustling Orchard Road commercial district. HDB used the profit (SG$137 million) from its land sales to help cover the operating deficits, as shown in Figure 8.18.

As Singapore's land brokers, HDB and URA have over the years strategically sold large amounts of development rights to shape Singapore's growth along railway corridors and to raise development funds. Since the early 1990s, the two entities have received nearly $SG28.7 billion (US$19.9 billion) (Tables 8.10 and 8.11). While HDB has leased mainly residential land parcels, URA has developed a mixed portfolio of projects including commercial, industrial, and residential uses.

Table 8.10. Government Land Sales awarded by HDB (*Except Ancillary Developments and Interim Use; Feb.1990-Oct. 2007). Source: Singapore HDB

Land Use	Site Area sq m	%	Price SG$ M	%	# of Sites	Lease (No. Years)
Residential	4,346,353	92.5	10,603.7	78.5	103	99, 103
Commercial	228,028	4.9	1,826.3	13.5	33	99
Mixed (Res. & Com.)	125,744	2.7	1,082.2	8.0	7	99
Total:	4,700,125	100.0	13,512.2	100.0	143	

Table 8.11. Government Land Sales awarded by URA (*Vacant Lands Only; Feb.1993-Oct. 2007). Source: Singapore URA

Land Use	Site Area sq m	%	Price SG$ M	%	# of Sites	Lease (No. Years)
Business	73,505	1.6	22.9	0.2	3	30, 60
Commercial	144,822	3.1	2,659.0	17.4	51	60, 99
Industrial	2,180,679	46.1	2,119.5	13.9	36	30, 60
Residential	1,695,402	35.8	10,117.9	66.4	380	99
Heavy Vehicle Park	248,504	5.3	45.0	0.3	22	10, 15, 99
Transitional Office	10,444	0.2	37.0	0.2	1	15
White	132,322	2.8	0.1	0.0	13	99
Others	244,715	5.2	243.3	1.6	12	15, 30, 45, 99
Total:	4,730,394	100.0	15,244.7	100.0	518	

Temasek Holdings and Government-Linked Companies

Temasek Holdings is a mega-investment company owned by Singapore's Ministry of Finance that manages a portfolio of over SG$160 billion across major industries: banking and financial services; real estate; transportation and logistics; infrastructure, telecommunications and media; bioscience and healthcare; education; consumer and lifestyle; engineering and technology; and energy and resources. Temasek's primary role is to leverage private investments in keeping with the nation's industrial development plan. Private companies for which Temasak is a major shareholder are called *government-linked companies (GLCs)*. In addition to HDA and URA, Temasak owns considerable shares in the SMRT. CapitaLand, Mapletree Investments, and Keppel Corporation are key government-linked companies that develop and manage property in concert with intermediate- and long-term plans (Table 8.12).

Table 8.12. Key Government-linked Companies owned by Temasek Holdings in Transport, Real Estate, and Infrastructure Industries

Source: Temasek Review 2006

Company	Temasek's Share %	Industry	Revenue FY 2005 SG$ M	Market Cap. FY 2005 SG$ M	Held Since
SMRT Corporation	55	Transport	673	1,397	1987
CapitaLand	42	Property	3,846	13,369	2000
Mapletree Investments	100	Property	161	2,244*	2001
Keppel Corporation	31	Property	5,688	10,850	1975

* Shareholder Equity

8.5 TOD Case Studies

This section builds upon the previous sections, using case studies to provide insights into property development and transit finance in the two comparative Asian city-regions. First, experiences in a variety of settings are presented for greater Tokyo, followed by examples of both central-city and new town development in Singapore.

Tokyo

Case examples are presented below for transit-oriented developments around JR East's terminal stations, Tokyu Corporation's suburban corridors, and the recently opened Tskuba Express line. In addition, evidence on the land value benefits of being close to railway stations in highly congested Tokyo is presented.

JR East

Since privatization in 1987, JR East has not sought to develop housing along its suburban corridors. Instead, the company has focused on commercial-retail projects. One initiative, called *Station Renaissance*, concentrates on small convenience retail facilities in stations. JR East has developed a micro-payment media business -- a Smart Card called *SUICA* – that can be used for consumer purchases and fare payments, placing vending machines in its stations to produce additional income. In central Tokyo, JR East has installed Station Renaissance at 11 busy terminal stations with a total of 26,350 sq m of retail space (Figure 8.19). JR East Omiya station, for instance, has about 600,000 passengers passing through it per day and averaged 27 million yen (US$240,000) in daily retail sales in FY2005.

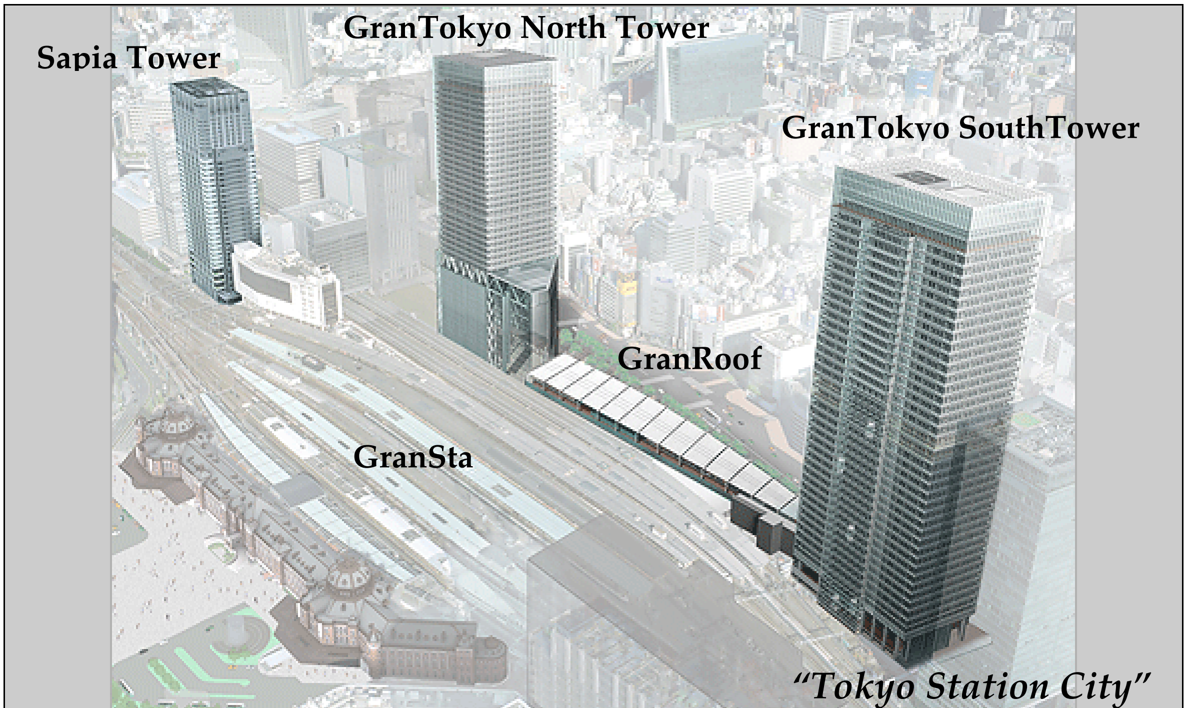
JR East has also pursued large-scale station redevelopment projects at three key terminal stations – Shinjuku, Shinagawa, and Tokyo – in close coordination with the national and Tokyo metropolitan governments. "Tokyo Station City" has become a showcase terminal-oriented project jointly developed by JR East and private interests featuring high-rise offices, retail shopping, and hotels (Figure 8.20). Tokyo station is well-suited for large-scale redevelopment owing to large amounts of buildable space above depots as well as high pedestrian traffic volumes. On a typical weekday in 2005, around a half-million passengers passed through Tokyo station each day.

Station	Open Year	Store Area sq m
Ueno	2002	5,900
Omiya	2005	4,900
Nishi-Funabashi	2005	2,100
Shinagawa	2005	1,600
Koenji	2006	450
Tachikawa	2007	4,100
Tokyo	2007	1,500
Tabata	2008	1,800
Mitaka	2008	1,500
Nippori	2008	800
Ofuna	2007	1,700
Total		26,350

Figure 8.19. JR East "Station Renaissance" Projects in Tokyo.
Source: JR East Fact Sheet 2007

Tokyo Metro

When privatized, Tokyo Metro was not authorized to pursue property development however in years these restrictions have been relaxed. Today, Tokyo Metro's managers recognize the value of several strategically sited land parcels (formerly owned by national government in the center of Tokyo). Still, property development remains mostly a sideline activity of the company, resulting in a piecemeal approach to leveraging property assets. Tokyo Metro has to date pursued only small-scale commercial or residential property developments in the core area and not all properties have direct access to subway stations (Table 8.13). One recent project of note is the Omotesando Echika station where three subway lines converge: a 4 billion yen (US$35.8 million) station renewal project with 27 retail store concessions covering 1,300 gross square meters (Figure 8.21). In return for using underground space, Tokyo Metro has to pay space rights to Tokyo Metropolitan Government's Road Bureau.



Development	Plot Ratio/ Site Area/ GFA/ Storeys	Office Leasing GFA %	Parking lots	Joint Developers/ Year of Opening
GranTokyo North Tower	8.73 19,670 sq m 171,770 sq m 43	36.7	120	Mitsui Real Estate Corpora tion; Celestine Hotel / 2007-2012
GranTokyo South Tower	26.80 5,230 sq m 140,168 sq m 42	54.9	280	Kashima; Nippon Oil Corporation / 2007
GranRoof	- - 2,000 sq m -	0.0	50	/ 2013
Sapia Tower	- 117,310 sq m 78,279 sq m 35	39.5	155	/ 2007
GranSta (*Station Renaissance)	- 4,500 sq m 1,500 sq m -	0.0	0	/ 2007

Figure 8.20. JR East's Large-Scale Joint Development: "Tokyo Station City"
Source: JR East Fact Sheet 2007, Mitsui Real Estate Corporation GranTokyo North Tower website, and JR East Building Ltd. website.

Table 8.13. Tokyo Metro's Properties in FY2006 (Source: Tokyo Metro)

Property Type	Total GFA sq m	%	# of Properties
Office	39,118	41.1	10
Hotel	7,581	8.0	2
Residential	12,146	12.8	14
Commercial Building	23,560	24.8	3
Commercial Space	5,302	5.6	7
Commercial Space (Under-Bridge)	7,459	7.8	6
Total	95,166	100.0	42

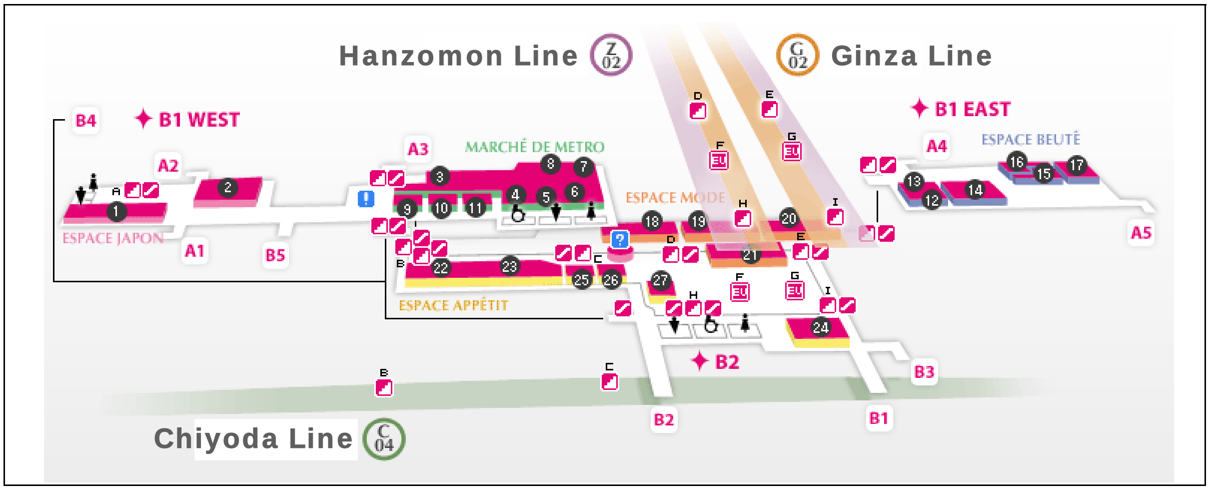


Figure 8.21. Tokyo Metro's Omotesando Station Echika Project (Source: Tokyo Metro website).

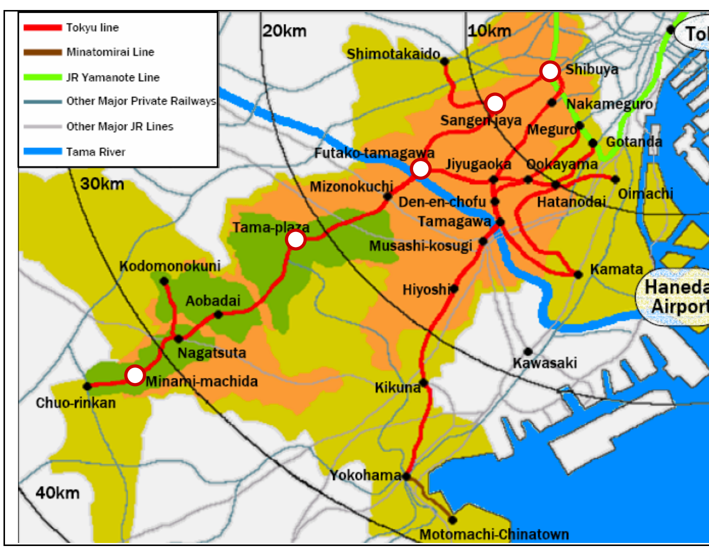
Tokyu Corporation

Tokyu Corporation has a long history of co-developing Garden City new towns and railway lines. This mainly in the 1950s and early 1960s, predating railway services that were built between 1966 and 1984. Railway construction cost was financed half by commercial loans and half by the Development Bank of Japan, with proceeds from land sales used to pay off loans. Gains in land values from the time properties were in agricultural use to when they were served by railways generated the profits needed to pay off commercial loans.

Particularly important to Tokyu Corporation's development process has been the practice of *land re-adjustment*, used to assemble parcels and finance ancillary infrastructure. Under this system, landholders (mainly farmers) gave up their properties and received back parcels of roughly half the size but that enjoyed full services (e.g., roads, piped water, electricity). Remaining land went not only to accommodate roads and public spaces like parks but was also sold to cover development costs. Tokyu's approach is widely viewed as the most successful example of value capture practiced by Japanese railway companies.

At present, Tokyu's 489 sq km business territory stretches over greater Tokyo's southwest quadrant, an area of 4.86 million inhabitants, 2.33 million households, and 17 municipalities and wards. Within this territory, Tokyu Corporation's most widely heralded garden city, Tama-Plaza, spans 15 sq km some 15 to 35 km southwest of central Tokyo and is home to 580,000 residents (Figure 8.22).

Railway companies like Tokyu Corporation have over the years captured value from railway investments because healthy rates of economic growth combined with worsening traffic congestion guaranteed handsome profits. However this has changed in the wake of stagnant population growth and a slowing of the economy over the past two decades. To spread risks, in recent times private rail way companies have partnered with third parties in pursuing large-scale development projects. For instance, recent developments of Tokyu Corporation have involved Real Estate Investment Trust (REIT) funding.



Entire Territory	
Area	489 sq km
Population	4.86 million
Household	2.33 million
Cities/Wards	17
Tama Garden City	
Area	50 sq km
Population	580,000

Figure 8.22. Tokyu Corporation's Business Territory and Tama Garden City
(Source: Tokyu Corporation Reference Data November 2006)

Besides a riskier development climate, private railway companies are facing increasing local opposition to densifying neighborhoods. NIMBYism (Not in My Back Yard) has prompted Tokyu Corporation to adopt an inclusionary approach to development, matching “hardware” design of station areas with “software” planning strategies, including activity citizens participation. Tokyu Corporation calls this the “PEA” strategy, as diagrammed in Figure 8.23. According to this four-prong approach: (i) each station development should be adapted and uniquely developed to each local community; (ii) station developments should yield wide regional benefits like improved air quality; (iii) mutual coordination and cooperation among stakeholders should be pursued; and (iv) station developments should be planned and implemented not just as one independent project but rather as a part of an entire corridor.

In recent years, several notable transit-oriented redevelopments have occurred along the Tokyu Garden City railway corridor. Table 8.14 highlights the five largest projects in terms of plot ratios, land-use mixes, and other development features. Mark City at Shibuya station and Carrot Tower at Shangenjaya station are two high-raise office projects near the center of Tokyo in Shibuya-Yamanote strategic area. Futagotamagawa station redevelopment is conceived as mid-rise office, shopping, and residential development. Tama-Plaza Terrace at Tama-Plaza station and Grandberry Mall at Minamimachida station are mid- and low-rise shopping malls in the Garden City strategic area, with a focus on environmental quality. Grandberry Mall was designed using the American model of auto-oriented big-box retail and ample car parking, situated near the Minamimachida station and a highway interchange.

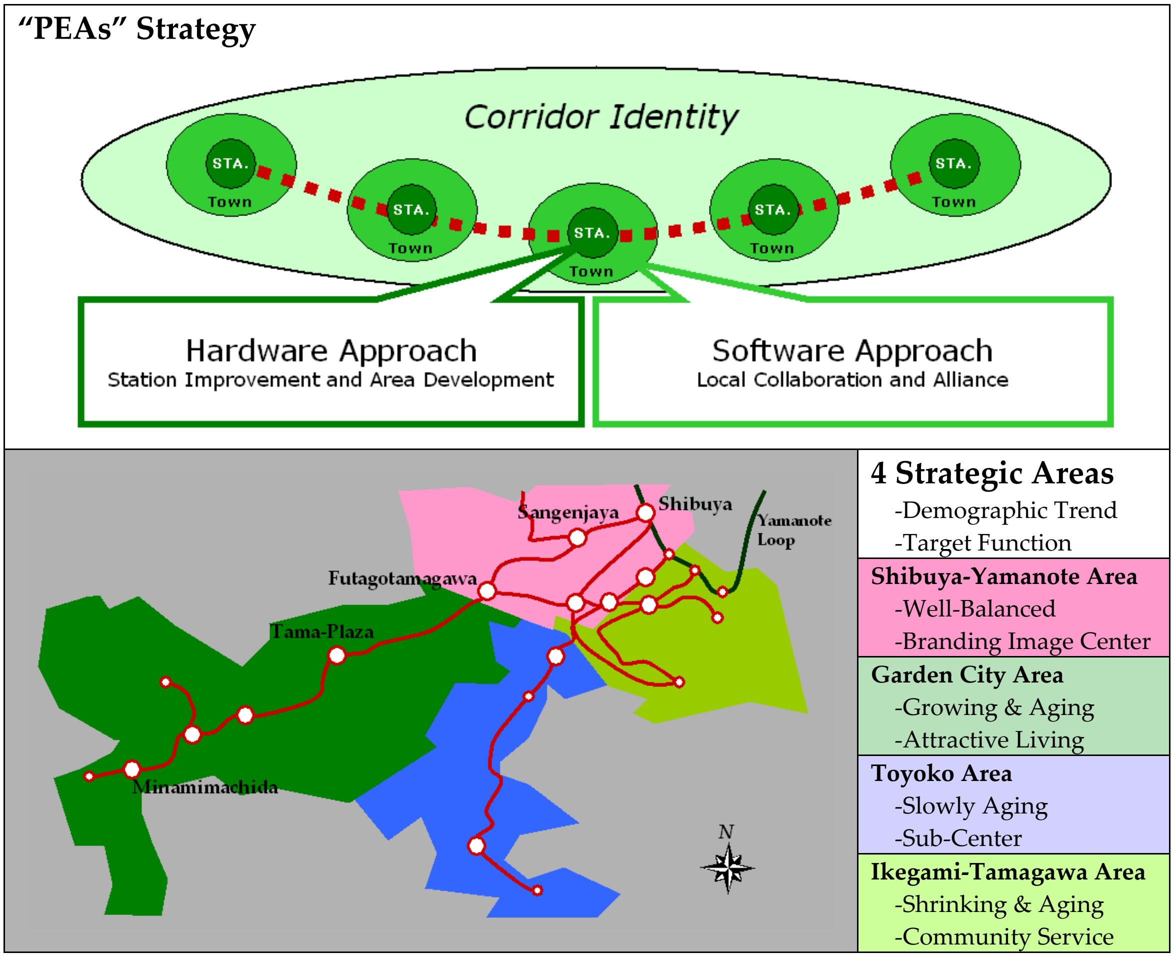
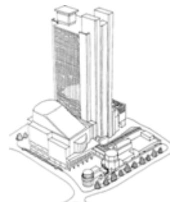
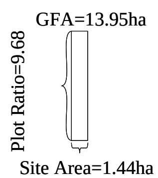
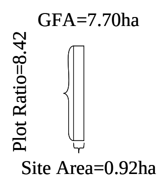
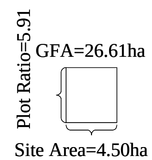
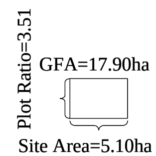
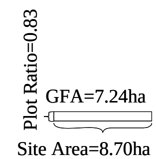


Figure 8.23. Tokyu Corporation's "PEAs" Strategy and 4 Strategic Areas
(Source: Tokyu Corporation Reference Data November 2006)

Table 8.14. Tokyu Corporation's Five Recent Transit-Oriented Development (TOD) Projects on the Garden City Line Corridor (Source: Tokyu Corporation)

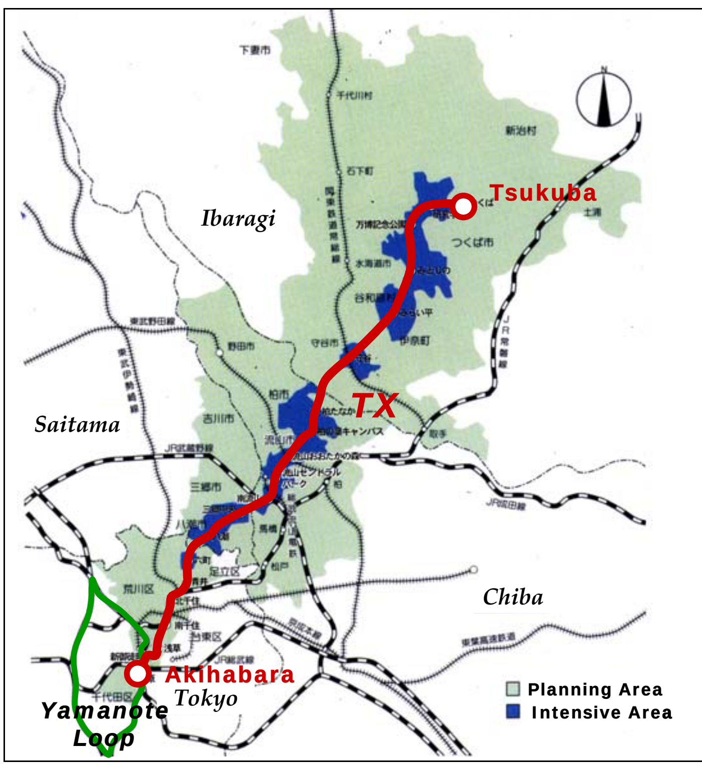
Station	**Shibuya**	**Sangenjaya**	**Futagotamagawa**	**Tama-Plaza**	**Minamimachida**
Project	Mark City*	Carrot Tower	East District Redevelopment	Tama-Plaza Terrace	Grandberry Mall
Distance from Tokyo km	0	3.3	9.4	17.1	29.2
Image					
Plot Ratio	9.68 	8.42 	5.91 	3.51 	0.83 
Site Area sq m	14,420	9,149	45,020	51,000	87,000
Total GFA sq m	139,521	77,000	266,100	179,000	72,400
Residential GFA %	-	-	43.7	0.0	-
Commercial GFA %	Some	Some	30.1	65.4	Main
Office GFA %	67.1	Main	11.0	0.0	-
Hotel GFA %	32.9	-	0.0	0.0	-
Others GFA %	-	-	15.1	34.6	Some
Parking Lots	454	564	NA	1,500	1,657
Construction Cost**	16.0 billion yen	6.0 billion yen	NA	NA	7.2 billion yen
Open Year	2000	1996	2009	2007-2010	2000-2007
Daily Ave. Pax. *** FY05'	631,481	113,799	66,059	64,238	27,970
% Since FY00'	7.8	3.6	9.4	-1.2	43.5

*Joint Development with Keio and Tokyo Metro
**Tokyu Corporation Only
***Garden City Line Only

Tsukuba Express

While most private railway investments in greater Tokyo have been in the southwestern suburbs, the latest suburban commuter line, Tsukuba Express (TX), lies in the opposite quadrant, in the northeast (Figure 8.24). Opened in 2005, the 58.3 km, 20-station corridor connects the Yamanote Loop Akihabara station and Tsukuba Science City, serving the Tokyo, Saitama, Chiba, and Ibaragi prefectures. Tsukuba Express cost 949.4 billion yen (US$8.5 billion) to build, financed as follows: 80% from no-interest government loans, 14% from local governments' contributions, and 6% from loans from the National Trust Funds (Zaito).

Land readjustment was used to assemble considerable amounts of right-of-way to accommodate and finance Tsukuba Express. In contrast to private railway development of the past, TX's land readjustment projects have been implemented by public entities (including the Urban Renaissance Agency, Tokyo Metropolitan Government, prefectures, and municipalities). These public entities assembled and consolidated land, returning portions to the original owners and selling much of the remainder to the Japan Railway Construction Agency at base (pre-railway) price (Figure 8.25). After JRCA completed



Metropolitan Government /Prefectures	Length km	# of Station
Tokyo	13.2	7
Saitama	7.4	2
Chiba	13.5	5
Ibaragi	24.2	6
Total	58.3	20
Open	August, 2005	
Railway Investment Billion Yen	940.4	
Ave. Daily Ridership	195,300 (FY06') 150,700 (FY05')	
Projected Land Developments	18 Districts 2,900 ha	

Figure 8.24. New Tsukuba Express Corridor in the Northeast part of Tokyo

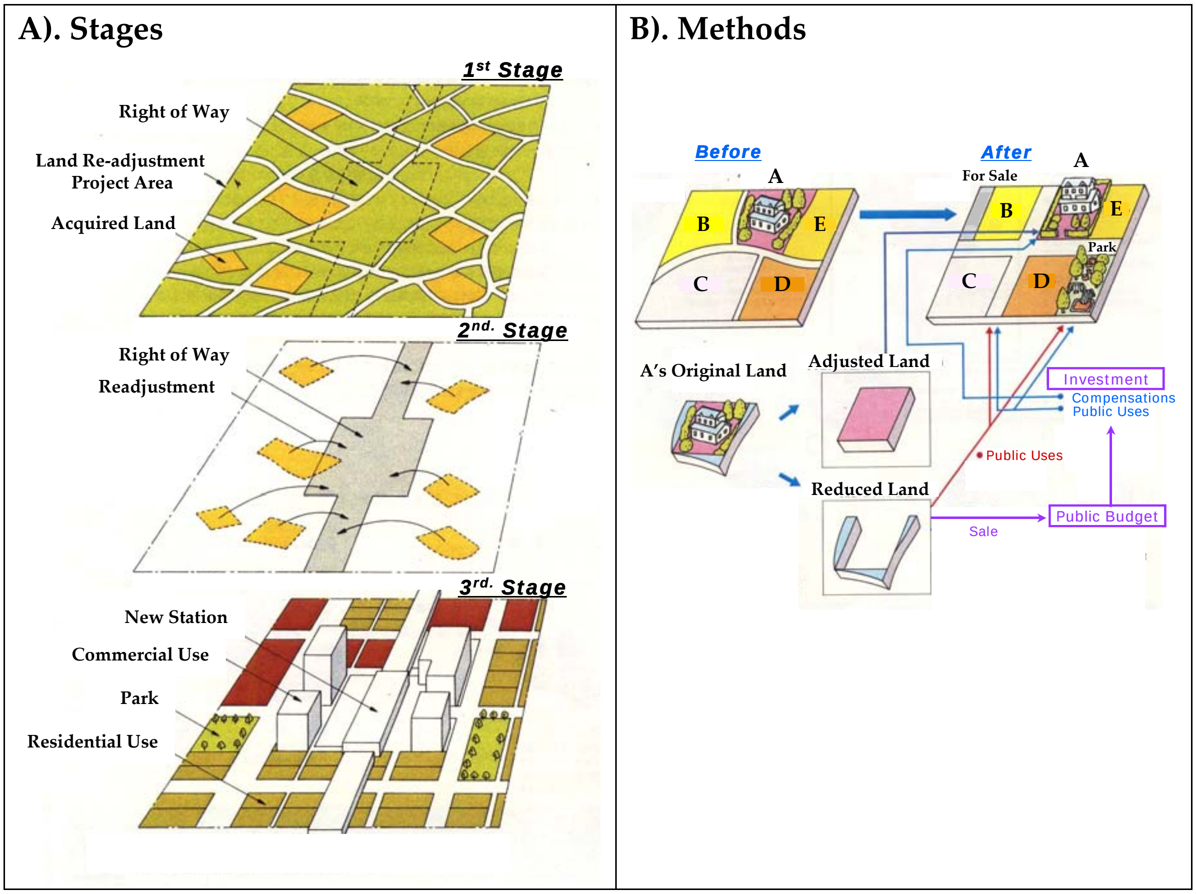
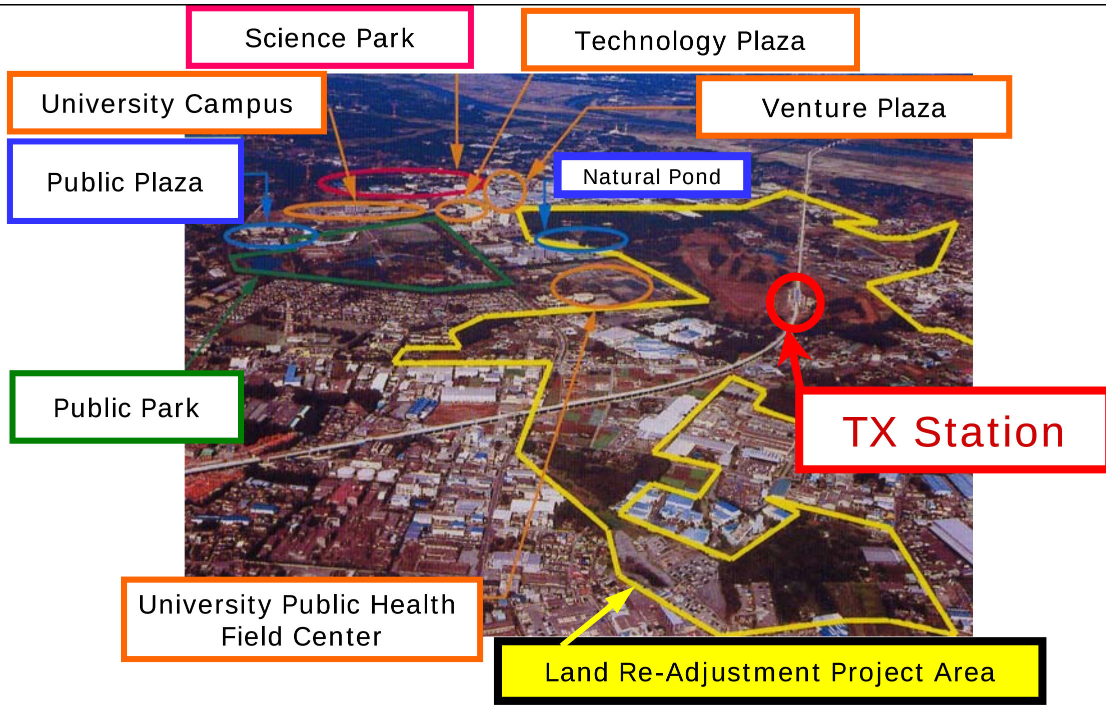


Figure 8.25. Land Re-adjustment Stages and Methods used in the Tsukuba Express Corridor. Source: Chiba Prefecture

construction, ownership of TX was transferred to a new quasi-private railway company.

In Chiba prefecture, six land readjustment projects were implemented to accommodate TX, spanning 1,081 hectares in size. About 40% of the original land was converted to right-of-way for TX and other public uses (like roads), or sold on the open market to raise public funds.

One notable land readjustment project has occurred near the Kashiwanoha station 30 km northeast of Tokyo's Akihabara station. There, a public golf course was taken over to accommodate the TX line and station as well as residences, a university, research institutes and high-tech parks, part of TX's larger scientific corridor from Akihabara to Tsukuba (Figure 8.26). The original golf course



Land Use Plan

Public Uses	%	Residential Uses	%	Other Uses	%
Road	24.4	Single Detached	21.1	Commercial	7.7
Park/Green	3.8	Complex	1.3	Industrial	11.6
Water	3.9	High-Rise Building	18.1	Education	2.8
				Public	4.5
				Railway Facility	0.8
Sub Total	32.1		40.5		27.4
Total					273ha (100.0%)

Figure 8.26. North Center Land Re-Adjustment Project and TX Kashiwanoha Station. Source: Chiba Prefecture

owner, Mitsui Real Estate Corporation, converted portions of its landholdings into a mid-rise residential tower (Park City) and shopping mall (LaLaport) (Figure 8.27). While a private business venture, Mitsui Real Estate Corporation has worked closely with local governments to promote transit-oriented new town development.

Property	Park City (Residential)	LaLaport (Shopping Mall)
Plot Ratio	4.98 Plot Ratio=4.98 GFA=14.43ha Site Area=2.90ha	3.47 Plot Ratio=3.47 GFA=14.45ha Site Area=4.17ha
Site Area sq m	28,983	41,654
Total GFA sq m	144,341	144,517
Residential Units	977	-
Parking Lots	-	2,400
Open Year	2008	2006

Figure 8.27. Mitsui Real Estate Corporation's Residential & Shopping Mall Development and TX Kashiwanoha Station.
Source: Mitsui Real Estate Corporation.

Tokyo's Land Prices across Railway Corridors

As a historically monocentric metropolis, residential land prices fall steadily with distance from central Tokyo. As shown in Figure 8.28, this pattern holds for the region's 15 major railway corridors. Within and along the Yamanote Loop, residential prices are generally double what they are 15-20 km from the center. Figure 8.28 further reveals that suburban housing costs considerably more along private railway corridors to the south, notably Tokyu, Odakyu, and Tokaido. Since 2000, however, the figure also reveals that residential land prices have fallen most rapidly away from the center, indicating a higher premium being placed on ease of access to the core. Indeed, the only area where residential land has gained value since 2000 is within and along the Yamanote Loop. This partly explains why private railway companies as well as former public entities like JR East are today concentrating on redeveloping strategic parcels near central stations and major terminals. Critics charge that opening new, modern retail outlets in and around stations simply redistributes sales transactions and seriously undermines retail activities away from stations. In October 2007, Tokyo Metropolitan Government levied a 2.2 billion yen (US$197 million) property tax on commercial businesses at 83 stations in the Tokyo 23 Ward in order to increase the competitiveness of retailers located away from stations.

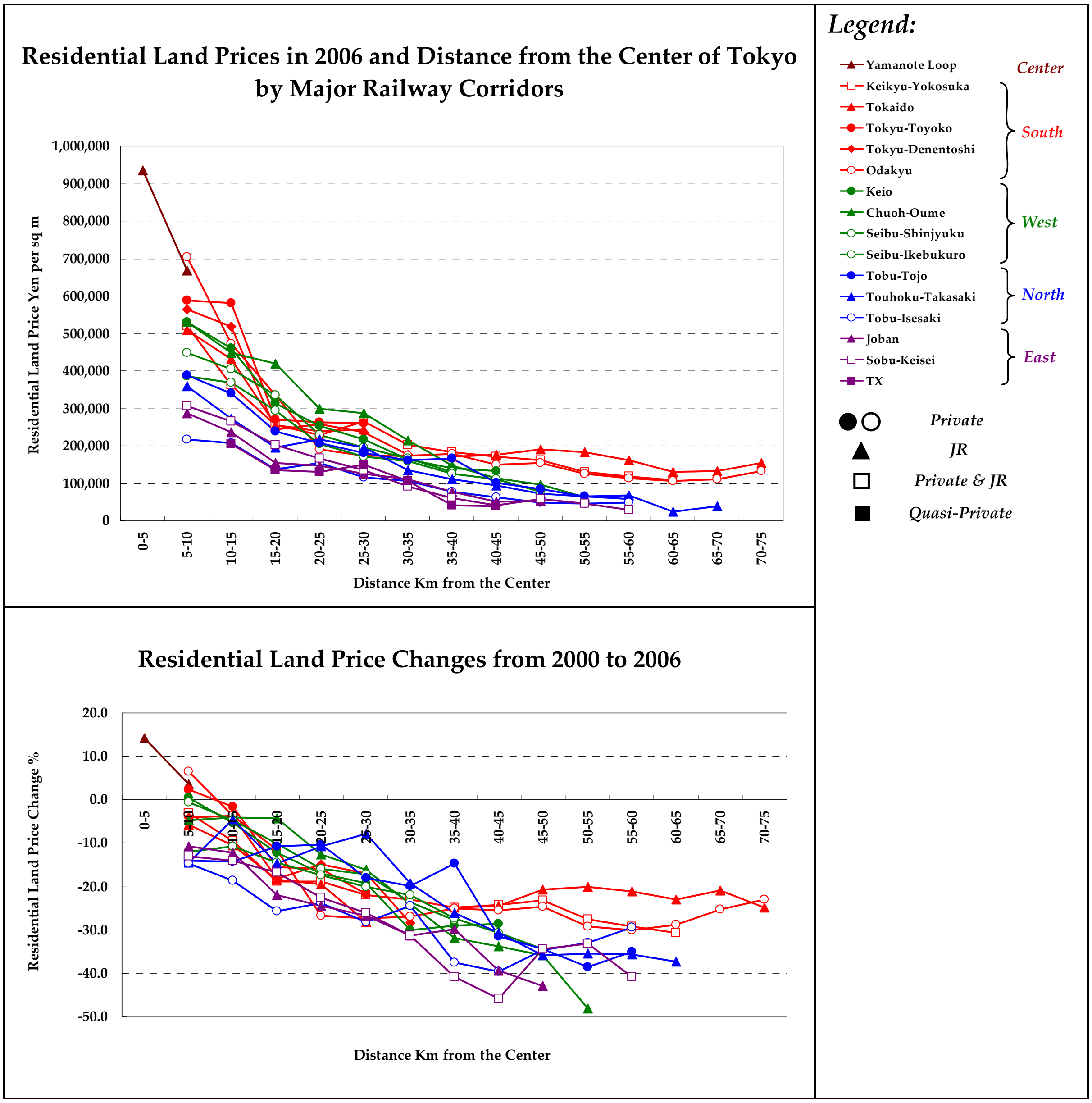


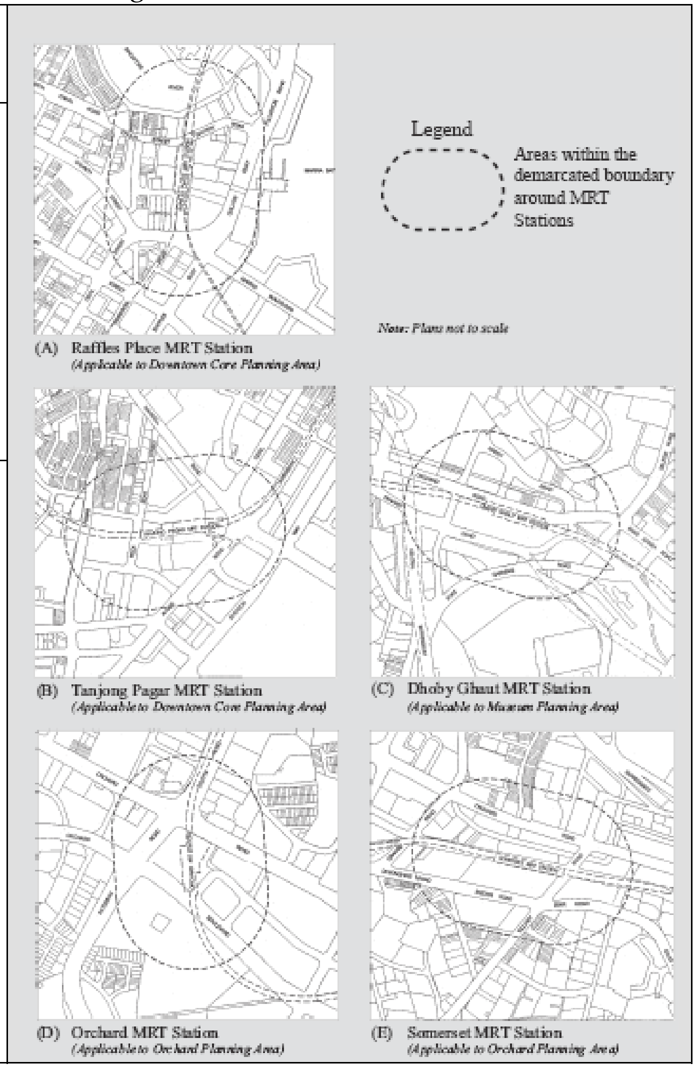
Figure 8.28. Residential Land Price Patterns from the Center of Tokyo by Major Railway Corridors. Source: Land and Real Property in Japan, Ministry of Land, Infrastructure and Transport

Singapore

In Singapore, density bonuses have been relied upon to promote compact development around stations. Figure 8.29 shows properties within MTR's catchment have enjoyed plot-ratio bonuses ranging from 5 to 15 percent.

Figure 8.29. Plot Ratio Bonus on MRT Station Area Developments in the Master Plan 2003. Source: URA, The Planning Act Master Plan Written Statement 2003.

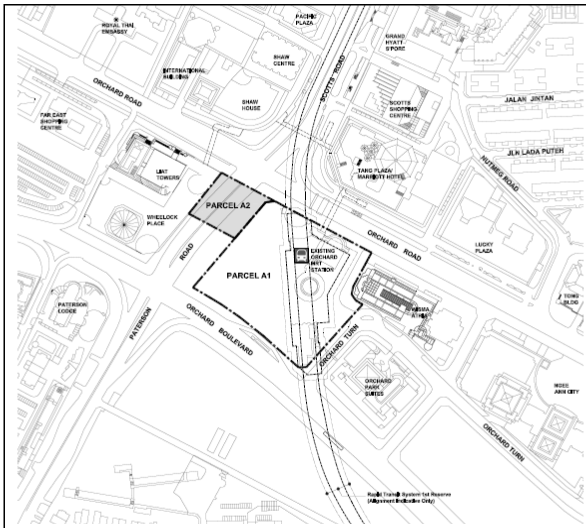
Criterion	% Increase Above Base Plot Ratio
MRT Radius	
-Less than 50% of the site is within the demarcated boundary	**5**
-50% or more of the site is within the demarcated boundary	**10**
Land Area (sq m)	
Downtown Core	
- 3,000 to 5,500	**5**
- 5,501 to 8,000	**10**
- 8,001 and Above	**15**
Museum & Orchard	
-10,000 to 15,000	**5**
-15,001 to 20,000	**10**
- 20,001 and Above	**15**



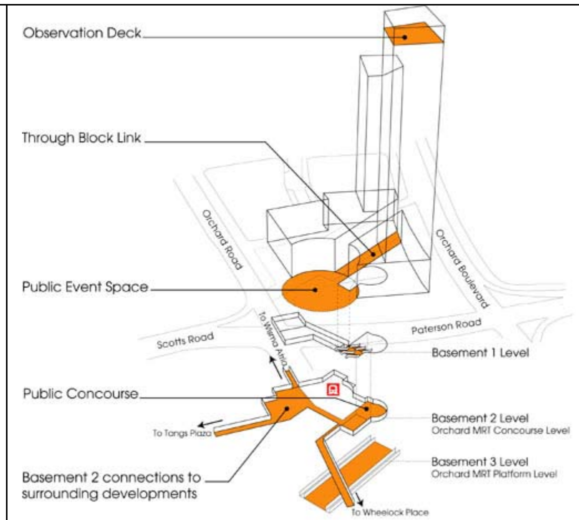
The Orchard Planning Area (one of the 55 planning areas in Singapore) has been recently targeted as an area for adding housing and public amenities in hopes of enlivening and increasing safety in the area. Located in central Singapore, the Orchard area has long been known for its vibrant mix of offices, shops, restaurants, and hotels. The 1994 Orchard Planning Report, however, pointed out shortcomings including: (i) lack of live-in population; (ii) automobile encroachment into pedestrian zones; and (iii) lack of well-planned open spaces and pocket parks.

Through the Government Land Sales programme of URA, the *Orchard Turn* project is now taking form near and above the Orchard Station (Figure 8.30). In 2005, the URA sold 21,732 sq m of development rights above and adjacent to the MRT Orchard station for SG$1.38 billion (US$959 million) to a government-linked real estate group company. The 99-year lease set specific conditions on land uses, permissible heights, open space provisions, and pedestrian circulation planning. The successful tenders, Capitaland Retail Singapore Investments Pte Ltd and Gresward Pte Ltd, formed a new joint company to build the high-profile mixed-use project: ION Orchard and The Orchard Residences (Figure 8.31).

Outside of central Singapore, similar approaches are being used to leverage TOD (Figure 8.32). At the outlying Punggol and Bishan stations, landholdings of the Housing and Development Board (HDB) are slated for modern residential development. Punggol is an interchange station for both MRT and LRT lines, serving large-scale housing developments in the Punggol Planning Area. Bishan is a sub-regional center that will become a major interchange station when the new MRT Circle line is completed in 2011. In a break from tradition, the development of a new mixed-use center at the Serangoon station, also on the planned Circle line, is being overseen by the Land Transport Aauthority (LTA), not HDB or URA. This signals a possible movement of Singapore's major transportation planning authority into the land development business along the lines practiced today by MTRC in Hong Kong and JR East in Tokyo.



Map



Development Features

Development Conditions		
Site Area sq m	Parcel A1	Parcel A2
	18,649.7	3,082+
Proposed Development	Commercial development with an underground shopping mall (incorporating a pedestrian walkway under Paterson Road)	
Maximum Permissible GFA sq m	The total GFA for the development shall not exceed 125,726 sq m. At least 40% of the total GFA of the completed development shall be for retail, food & beverage and/or entertainment uses (*Plot Ratio = 6.72).	
Maximum Building Height	218m AMSL (Above Mean Sea Level)	
Lease Period	99 years	
Project Completion Period	9 years	
Minimum Bid Price	SG$ 600 Million	
Successful Tender Price	SG$1.38 Billion	
Successful Tender	Capitaland Retail Singapore Investments Pte Ltd & Gresward Pte Ltd	

Figure 8.30. Orchard Turn project at Orchard MRT Station, 2005.
Source: Singapore URA.

Construction Cost $:	**SG$478Million**
Projected GFA Uses:	**ION Orchard (Retail Space: 70-75%)**
	The Orchard Residences (Super Luxury Homes: 25-30%)

Figure 8.31. Orchard Turn Mixed Development Project Site.
Source: URA; CapitaLand and Sun Hung Kai Properties.

8.6 Summary

Hong Kong, Tokyo and Singapore have modern and extensive railway systems, though their approaches to station-area development and transit finance have been quite different. Tokyo has a long tradition of private companies awarded exclusive franchises for co-developing railways and new towns. This, however, occurred mainly in the middle part of the 20th century when fairly cheap agriculture land was being converted to urban uses through land consolidation/re-adjustment and huge windfall profits were possible. As greater Tokyo has expanded and land prices have sharply risen, the responsibility for financing railway development has shifted to the public sector. At the same time, however, the privatization of former state-owned railway companies has led to the formation of public-private partnerships for redeveloping office and commercial properties above and near terminal stations. Because property development has become more competitive and risky, private railway and real-estate companies are now partnering with governmental bodies to rebuild urban districts around major central-city stations.

In recent years, both Tokyo and Singapore have increasingly relied upon government assistance -- in the form of cash grants, bonds, loan credits, and land grants -- to leverage station area development. Singapore has aggressively developed its world-class railway network using transfer payments from the consolidated national account, funded in part through high automobile-related charges and land-related taxes, fees, and sales.

Similar to experiences in Hong Kong, over time Tokyo's privatized railway companies have understood the strategic importance of air rights and depot space above and adjacent to railway stations, particularly in the urban core. However, commercial redevelopment around Tokyo's central terminal stations has been motivated more by the promise of short-term financial returns than, as is increasingly the case in Hong Kong, by longer-term place-making objectives. Redevelopment is also occurring around Singapore's central MTR stations, notably in the Orchard Road area. In Singapore's case, railway and property co-development are generating good economic returns, however through the strong hand of government regulation, high motoring charges, and visionary regional master planning, the island-state is also focusing on quality of place and neighborhood investments. In Singapore, as in Hong Kong, place-making is viewed as an integral part of the longer-term economic development strategy.

Compared to Hong Kong, both Tokyo and Singapore have a more complex institutional landscape of public and private partnerships for leveraging station-area development, in part to spread risks but also to ensure close government oversight in building world-class transit. In Singapore's case, railway and property development are implemented by different government authorities, all financed through the largesse of central government. In Tokyo, a dozen different companies offer railway services and not all have pursued land development.

By way of summary, Table 8.15 compares approaches to property development, railway investments, and land management in Hong Kong, Tokyo and Singapore. The degree to which these experiences might be applied to other parts of the world, notably rapidly urbanizing parts of China, are taken up in the next, concluding chapter.

Figure 8.32. MRT Stations and New Government Land Sales Programmes through HDB and LTA in FY2007. Source: Singapore HDB and LTA.

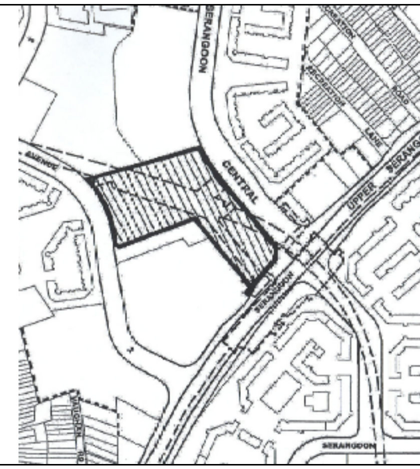
Station	**Punggol**	**Bishan**	**Serangoon**
MRT/LRT Line (Open)	**North East (2003) Punggol LRT (2005)**	**North South (1987) Circle (2010-2011)**	**North East (2003) Circle (2010-2011)**
Property Location			
Property Name	**Punggol Field/ Punggol Road**	**Bishan Street 14**	**Serangoon Central**
Property Type	**Residential**	**Residential**	**White Site**
Site Area ha	**2.27**	**1.20**	**2.50**
Plot Ratio	**3.0**	**4.9**	**3.5**
Estimated # of Housing Units	**620**	**535**	**280**
Estimated Commercial GFA sq m	**0**	**0**	**49,000**
Launch Date	**November 2007**	**November 2007**	**December 2007**
Sales Agency	**HDB**	**HDB**	**LTA**

Table 8.15. Conceptual Summary across Hong Kong, Tokyo and Singapore

Domains		Hong Kong	Tokyo			Singapore
			Private	Former SOE	SOE	
Property	Management Development Owner	Com **+MTRC**	Com **+Rail Com**	Com **+Rail Com**	Com	Com +GL Com +SOE
Railway	Operation	**MTRC**	**Rail Com**	**Rail Com**	**Rail SOE**	**Rail GL Com**
	Construction		SOE			SOE
	Owner		**Rail Com**	**Rail Com**	**Rail SOE**	Gov
Land	Owner	Gov	**Rail Com**	**Rail Com**	**Rail SOE**	Gov
	Assemble	Gov	**Rail Com** +Gov + SOE	Gov + SOE	Gov + SOE	Gov
	System	**Publicly Owned: Land Leasing**	**Market Freehold: Land Re-adjustment**			**Publicly Owned: Land Leasing**
Operation &Finance Features	Market	Duopoly	Competition			Duopoly
	Geography	Whole	Suburban Corridor	Center & Suburban Corridor	Center or Suburban Corridor	Whole
	Transport Return %	155	120	135-160	95	110-120
	Real Estate Return %		120	140	-	-
	Value Capture Methods	**Direct** -Auction Premiums -Owner Benefits -Concessions	**Direct** -Property Sales -Owner Benefits -Concessions	**Direct** -Owner Benefits -Concessions	**Indirect** -Land Sales -Property Taxes	**Indirect** -Auction Premiums -Property Taxes
	Property Types	Office/Commercial/ Residential	Office/Commercial/ Residential	Office/Commercial	-	-
	Cross Subsidization from Automobile	**No**	**Yes**	**Yes**	**No**	**Yes**
	Gov. Capital Assistance	-Land Grant	-Cash Grant, Bond -Credit for Loan			-Land Grant -Cash Grant, Bond

* Com: Company/Gov: Government/ GL: Government-Linked/ SOE: State-Owned Enterprise

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Chapter Nine

Lessons and Extensions

9. 1 Summary and Insights

Hong Kong's experiences with the R+P programme reveals that transit value capture, first introduced in the United States over a century ago, is still a viable model – not only for sustainable finance but also sustainable urbanism. MTRC is able to offer shareholders appreciable returns on investment via property development, which presently generates over half of the company's income. Streams of income from past R+P projects help finance future railway extensions; these expansions in turn spawn their own R+P projects that finance capital investments even further downstream. Rail and property development has created a virtuous cycle of railway capital financing and a highly transit-oriented built form.

R+P is more than an end-product of "brick and mortar" atop subway stations. As importantly, it is a carefully conceived process for planning, supervising, implementing, and managing station-area development and tapping into the land-price appreciation that results. MTRC's role as the master planner – from conceptualizing development opportunities to post-construction management of real-estate projects – has provided the kind of continuity, accountability, and resourcefulness that appeals to investors and tenants and thus seeds the programme's financial success. R+P has also contributed to achieving larger regional development objectives, in particular a "necklace of pearls" urban form that is conducive to transit usage and conserves land resources.

A variety of R+P projects exist in Hong Kong today. Most focus on housing development though all have some degree of commercial uses as well. In general, the more accessible the location that is served by MTRC, the more likely the R+P project is a high-rise and high-valued office-commercial venture in the air rights above an MTR station. Recent generation R+P projects have placed a stronger premium on urban design and quality of pedestrian environments. This has been the case not only for peripheral locations on former Greenfield sites, like Tung Chung, but also redevelopment sites on former brownfields, like Tseung Kwan O. Investing in improving the quality of urban space in and around stations has generally paid off in the form of ridership gains and higher real-estate prices. It has also positively contributed to Hong Kong's standing in the global economy, appealing to amenity-conscious professional-workers and businesses that depend upon the agglomeration benefits made possible by Hong Kong's world-class transit network.

Empirical evidence underscores the benefits conferred by designing R+P projects according to TOD principles. The direct ridership models presented in this paper suggest that all else being equal, a transit-oriented design adds as much as 35,000 additional weekday passengers (traveling in both directions) to stations with R+P projects. The biggest ridership bonus comes from transit-oriented development tied to large-scale residential R+P projects. Land markets also capitalize the benefits of R+P. Housing price premiums in the range of 5% to 17% were found for units built using the R+P model. If R+P projects had distinctively transit-oriented designs, the premiums exceed 30%. Empirical evidence that shows sustainable transit finance and sustainable urbanism are reinforcing is good news for policy-makers, real-estate developers, and smart-growth advocates. With an increasing demand to live, work, shop, and run businesses in high-quality districts well-served by public transport, tremendous profits can be generated from the co-development of railway systems and new real-estate projects that benefit both public and private interests – a "win-win" outcome that lies at the core of all successful public-private partnerships.

When compared with approaches to transit finance in two other major Asian city-regions with world-class transit systems – Tokyo and Singapore – Hong Kong's R+P program most directly embraces beneficiary principles of transit finance. While private railway corporations aggressively practiced value capture in greater Tokyo during much of the second half of the 20th century, in more recent years local and national government grants and interest-free loans have been relied upon to finance new railway extensions. This is due in large part to larger macro forces that have increased the risk of rail investments among private corporations – notably, stagnant population growth and increasing market interest in central-city redevelopment as opposed to outlying new towns. Similarly, Singapore finances a considerable share of its fixed-guideway transit investments through the largesse of the central government. Within the transportation sector, cross-subsidies flow from motorists to public-transport interests in the form of high charges for vehicle licensing and registration, gasoline taxes, and driving during peak periods. Unlike in Hong Kong and Tokyo, railway authorities are not actively involved in Singapore's construction of TOD projects; rather, other government land-development authorities take on this responsibility in collaboration with private real-estate syndicates.

Neither Tokyo nor Singapore has the kind of unified decision-making framework found under R+P. In both places, the coordination of railway and land development occurs in a more fragmented, piecemeal fashion. Hong Kong's reliance on a single entity, MTRC, to oversee and coordinate railway planning, design, and post-construction activities provides an unusual degree of continuity, transparency, and accountability. It most likely increases profits and protects assets as well. Having a single entity like MTRC, some might contend, increases the risk of an all-powerful monopolist controlling railway and land development. However ownership by the government of Hong Kong of more than half of MTRC's equity shares prevents this from occurring, ensuring that the broader public interests are weighed in all investment decisions.

By way of summary, several key lessons fall out of this research:

- Transit value capture (e.g., R+P) promotes both financial and broader urban-growth objectives when the "3D" model (density, diversity, and design) is well-executed, creating a "win-win" outcome for all parties involved;

- Societal benefits of building R+P projects according to transit-oriented design principles are expressed not only by high financial returns but also healthy real-estate markets and a ridership bonus;

- Both TOD and transit value capture work best when strategically planned and designed at a corridor and regional level, as underscored by experiences in Hong Kong, Tokyo, and Singapore; and

- Potentially tremendous benefits can accrue from extending transit-value capture models, like R+P, to fast-growing parts of the world, particularly those in Asia.

9. 2 Extensions of the R+P Model

As suggested above, the potential benefits of applying the R+P model elsewhere, such as in other fast-growing cities of Asia, are quite high. One might argue that Hong Kong represents an extreme case in terms of urban densities and traffic congestion, and that the potential returns from transit joint development elsewhere will be far more modest. However, many coastal cities of mainland China are beginning to mimic Hong Kong's high-rise development pattern and today are veritable beehives of industrial expansion and entrepreneurialism. Worsening traffic congestion and air quality call out for sustainable patterns of urbanization, ones that rely on inherently the most efficient form of motorized transportation – mass transit.

China's rates of urbanization and the private automobile travel that accompanies it have been staggering. Since 1978 when China's central government introduced its open-door policy of economic form, urban population has grown from 80 million to more than 560 million, averaging an annual growth rate of 7.5% (Lin, 2002; Zhang, 2007). Vehicle ownership has increased at more than twice this rate over the past decade in many big cities. In Shanghai, the number of registered private automobiles jumped from 200,000 in 1991 to 1.4 million in 2002 (Zhang, 2007). Such swift pace of growth has overwhelmed roadway networks. In central Beijing, the average travel speed plummeted from 45 kph in 1994 to 12 kph in 2003. During peak hours, one-fifth of Beijing's roads and intersections come to a standstill, with traffic speeds less than 5 kph.[1] Traffic snarls have worsened air quality. A recent World Bank study shows that of the 20 most severely polluted cities in the world, 16 are located in China.[2] Threats to global pollution are cause for alarm. Currently, the world's second largest greenhouse gas emitter, China is on a pace to surpass the U.S. in 2008 (Fraker, 2006).

China's leaders are today turning to railway investments in hopes of stemming the threats posed by rising motorization. Urban rail systems are currently found in 12 mainland Chinese cities.[3] Plans call for expanding and upgrading existing rail systems and building new ones in 15 other Chinese cities. Bus Rapid Transit (BRT) systems are also being built or expanded in Beijing, Tianjin, Chengdu, Xian, and Kunming. Tianjin and Dalian operate trams on central-city streets. Opportunities for creating sustainable city forms through bundling land development and railway investments in large Chinese cities are largely untapped and quite substantial.

MTRC has already entered the mainland China market, having won a concession to build Line 4 of Shenzen's metrorail line through 2.9 million square meters of "rail + property" development. The company has also been eyeing markets in

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[1] See: http://www.usc.cuhk.edu.hk/wk_wzdetails.asp?id=2906

[2] See: http://www.economist.com/business/displayStor.cfm?story_id=3104453

[3] Starting in the early 1990s, cities such as Beijing, Shanghai, and Guangzhou built multiple underground metro lines, with transit serving well over a million passenger trips per day in each city. In more recent years, other large Chinese cities have followed suit, including Tianjin, Nanjing, Shenzhen, Shenyang, Chengdu, Dalian, Harbin, Wuhan and Chongqing.

Beijing, Wuhan, Shanghai, Hangzhou, and Tianjin. In an interview in the *South China Morning* Post, Sir C.K. Chow, CEO of MTRC, was asked about the potential of extending the R+P model to China. He responded:

> It's too early to predict whether revenue from overseas operation will be bigger than Hong Kong. We are only at the beginning of the journey but I think the potential in China is much bigger than the potential in Hong Kong, and MTRC is best positioned to take advantage of that.[4]

Many Chinese cities are approaching the size (roughly 5 million inhabitants) and density thresholds (15,000 inhabitants per square kilometer in the urban core) often thought necessary to justify high-capacity railway investments (Cervero, 1998). And many are becoming more and more automobile-oriented. Approximately twice as large in population, Beijing has 2.8 million registered vehicles compared to Hong Kong's 0.5 million.

A first step to advancing models like R+P is to elevate the importance of integrating public transport and urban development more generally. To a large extent, there has been a disconnect between the two. Beijing currently operates four rail transit lines, with a total track length of 114 km. Beijing's rail transit expansion has been accompanied by a real estate boom. Yet there is a lack of integrated planning and development, although new buildings might be spatially proximate to rail stations. Housing projects followed Beijing's rail transit networks, but jobs and service have not (Zhang 2007). Many new communities developed along rail corridors have become veritable bedroom communities. Skewed commuting patterns have resulted. A study of three residential new towns in Beijing's rail-served northern suburbs found as many as nine times the number of rail passengers heading inbound in the morning peak as heading outbound (Lin and Zhang, 2004). Poor integration of station designs with surrounding development has led to chaotic pedestrian circulation patterns and long passenger queues at suburban stations like Xizhimen on Beijing's Line-2 (Zhang, 2007).

The absence of station-area master planning has also led to substandard development. A case in point is Beijing's Sihui interchange station on Lines 1 and 8 between the 3rd and 4th ring roads. There, a massive concrete slab was built

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[4] T. Shuk-wa, "MTR Corp Chief Steers Company to New Highs. *South China Morning Post*, December 15, 2006, p. S4.

over the 40-hectare depot site next to the station, enabling the Beijing City Underground Railway Company to lease 700,000 m^2 of air-rights to developers. No design or development standards, however, were set as part of the lease agreement. To economize on the cost of a thousand-plus apartments built atop the site, only one footbridge was built to the Sihui subway station. Overcrowded sidewalks and queues at the station entrance have severely detracted from the station environment, resulting in land prices that are below tracts farther from the station. The poor-quality environment surrounding the Sihui station underscores the importance of a master planning entity that oversees project development and ensures a functional relationship unfolds between the public and private realms of station settings.

Beijing's officials seem aware of past shortcomings and are seeking to change course. In concert with master planning for the 2008 Olympic Games and beyond, Beijing's municipal government established the following transportation development guideline:

> The public transportation system will also be fully exploited as a functional instrument in guiding Beijing's urban development. Urban land development with transit-oriented development (TOD) will be employed to rationalize Beijing's layout and provide reliable transportation supporting facilities for the development of scattered groups and small towns in the suburbs.[5]

An important challenge in cities the size of Beijing is to think of TODs as more than nodes in isolation. TOD planning and finance needs to be tied to a larger regional plan, one that casts TODs as part of a network, what some have called "transit oriented corridors" (TOCs) (Cervero, 2007). When conceptualized as part of a strategic regional planning effort, international experiences show that an integrated network of TOCs can sum to a "Transit Metropolis", arguably the most sustainable pattern of urbanization in megacities of the world (Cervero, 1998).

The research presented in this report could be helpful to Chinese planners seeking to advance TOD principles. Notably, the typology of R+P projects presented in Chapter Four provides insights into the built-environment attributes of various TOD prototypes. The 3 Ds -- density (e.g., plot ratio),

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[5] http://www.ebeijing.gov.cn/Government/OlympicPlan/t1138.htm

diversity (e.g., land-use mix), and design (e.g., skywalk network) -- of MTRC's R+P projects varied markedly among prototypes (e.g., central-city office developments versus peripheral new-town projects). TOD prototypes are needed as Chinese cities seek to strategically develop their railway networks and comprehensive land-use plans. Such prototypes would help move TOD from a broad concept to an applied model of urbanism based on various functions of stations and scales of development – e.g., TODs as new towns, interchange stations, high-tech employment nodes, urban redevelopment districts.

Clearly, experiences with R+P and other approaches to transit joint development cannot be applied to Chinese cities carbon copy-like. Hurdles exist. Government's ownership and control of land is one potential stumbling block. Private companies cannot own land outright and navigating through the thicket of local and central government bureaucracies overseeing land rights and prices is fraught with risks and uncertainties. The trend toward single-use, master-planned projects with repetitive architecture on superblocks in suburban settings could also work against TOD. So is the emphasis on lacing Chinese cities with massive thoroughfares and expressways in an apparent attempt to mimic western patterns of infrastructure and suburbanization. Still, the principle of value capture is an idea that resonates with many Chinese officials. A recent Asian Development Bank report (2005) suggests widespread interest in the People's Republic of China for the adoption of public-private partnerships for urban rail. As rapid urbanization continues to choke the streets of many Chinese cities with traffic and threatens environmental quality locally and on the global stage, it is imperative that arguably the most sustainable form of urbanism – the linkage of land use and public-transport – be aggressively pursued. Hong Kong's R+P model, we believe, is the best template available for sustainably financing transit and building cities.

Certainly elements of transit/land-use policy from the case comparison cities reviewed in this report – Tokyo and Singapore – also have applicability to rapidly developing parts of the world like China. Singapore's approaches to transportation demand management, such as dynamic road pricing, clearly reinforces initiatives to promote transit-oriented development, whether done through the R+P model or any other approach. Recent experiences with terminal-station redevelopment projects in Tokyo similarly have potential for major intermodal facilities in large Chinese cities. However, no approach to transit finance has as big of a potential payoff for rapidly growing cities of China and the developing world than R+P. Owing to the inherent efficiencies of beneficiary financing and the potential to create a virtuous cycle of rail-induced financial gains and high-quality urban development offers tremendous opportunities to place fast-growing cities on a more sustainable pathway – in terms of both railway finance and city design.

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Zhang, M. 2007. The Chinese Edition of Transit-Oriented Development. *Transportation Research Record*, forthcoming.

Appendix 1

Dendogram "Tree Diagram"

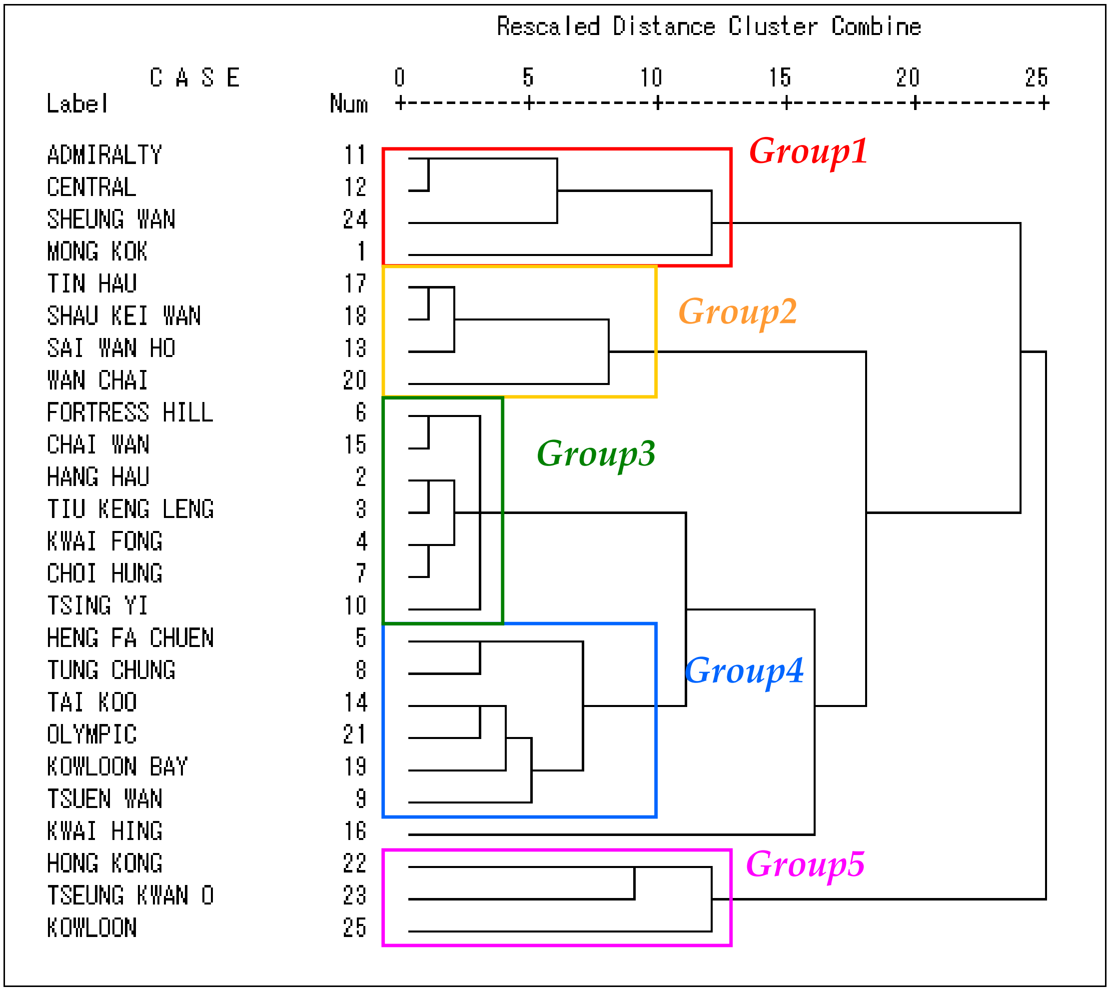


Figure A1.1. R+P Typology based on Built Environment Variables

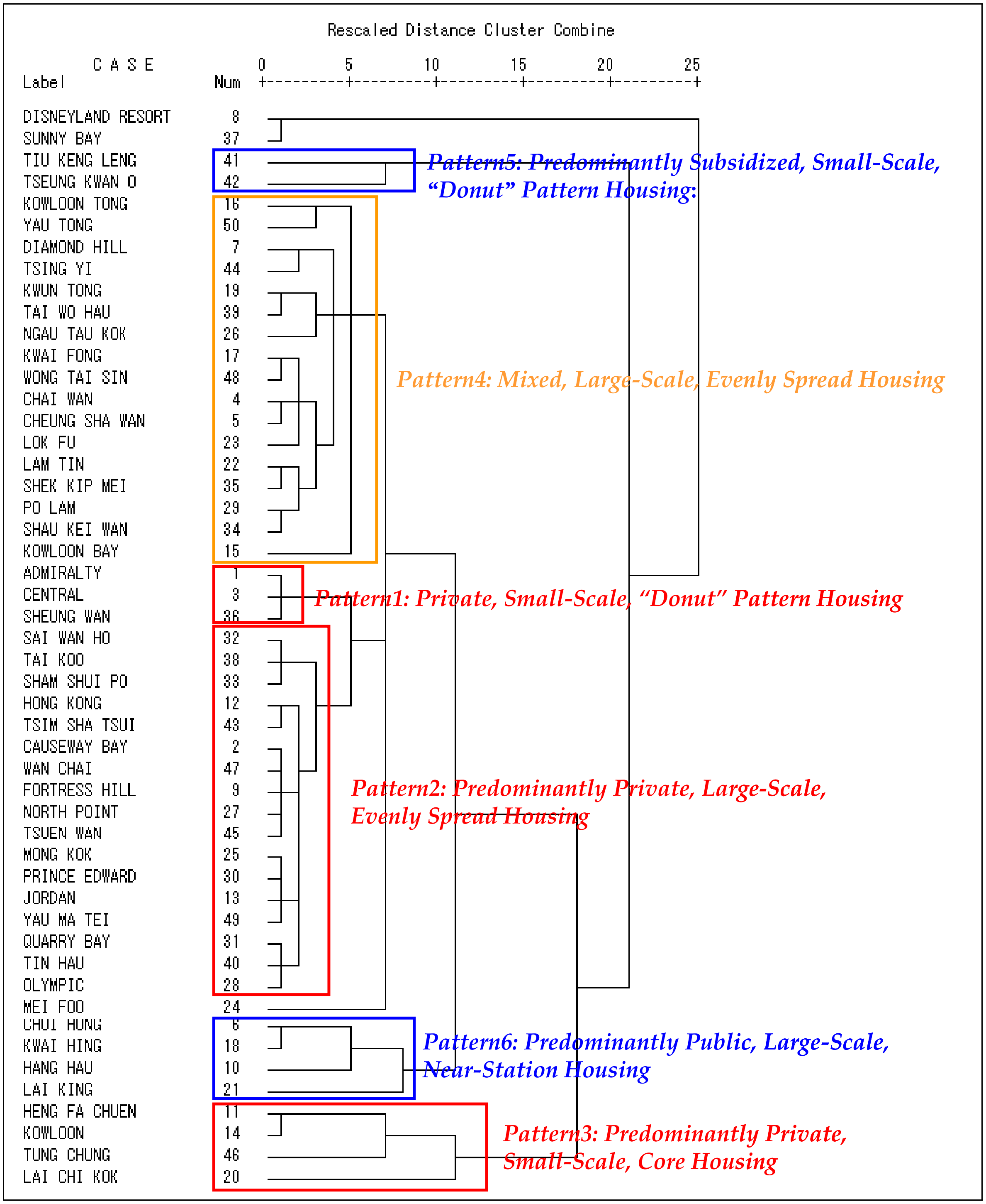


Figure A1.2. Typology of Housing Developments around MTR Stations

Appendix 2

Quality of Catchment Area

Five R+P Cases

A2.1 Admiralty (HO)

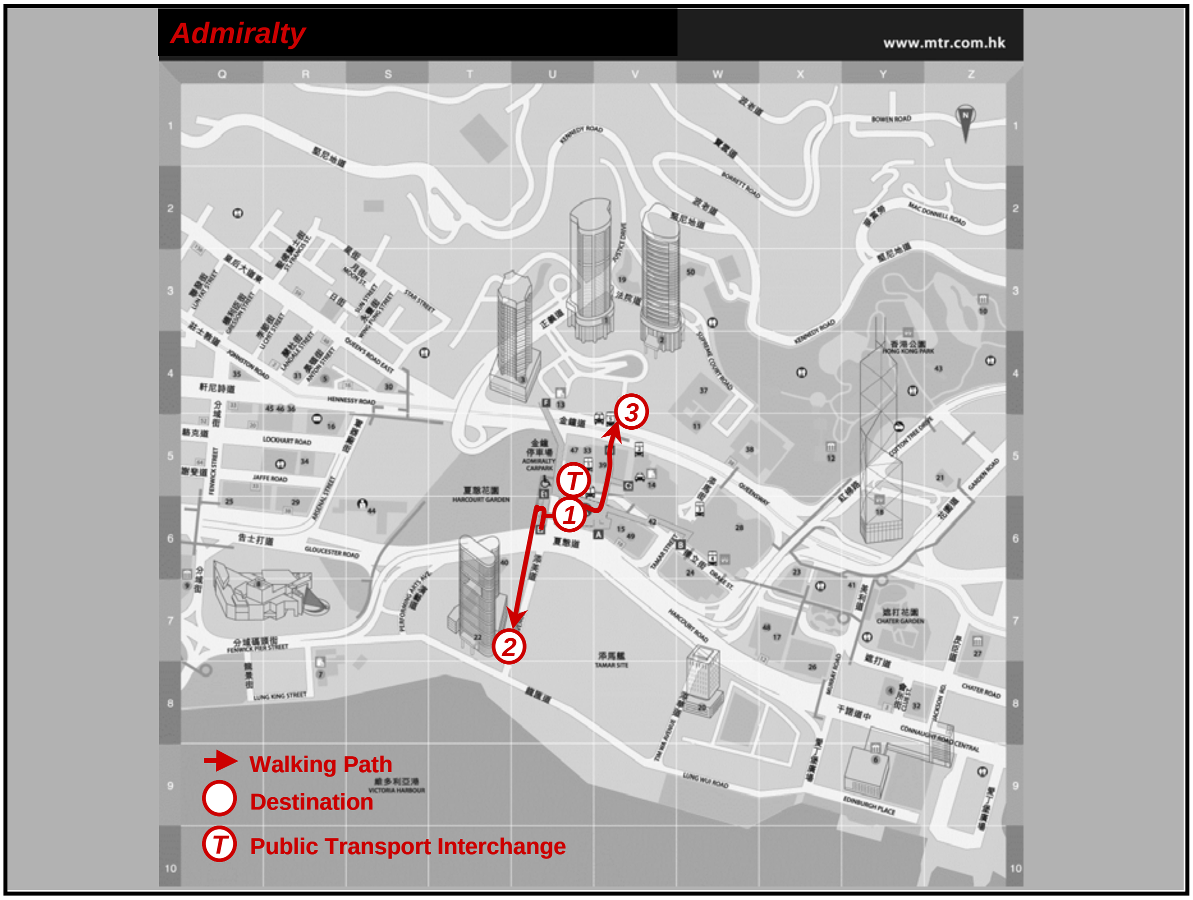


Figure A2.1.1. Admiralty (HO) Catchment Area Map

Office Buildings on MTR | Shopping Mall above MTR | Footbridge Network

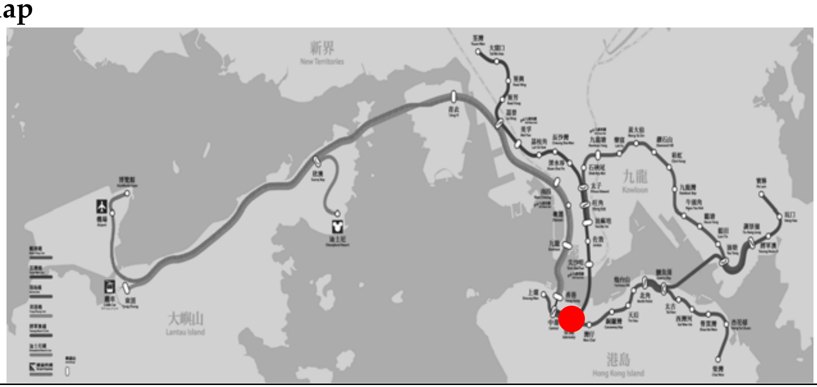
PTI at the Ground Level | Integrated Entry/Exit | Public Signage System

Footbridge to Gov. Office | Footbridge to Citic Tower | Green Pocket

Figure A2.1.2. Admiralty (HO) Catchment Area Photos

Table A2.1.1. Admiralty (HO) Case Summary Sheet

Location Map

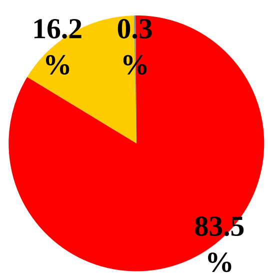


Site Map

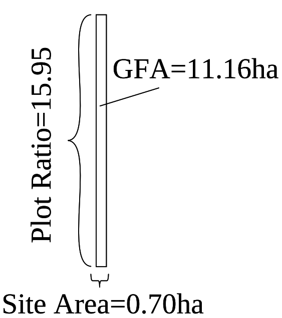
R+P Land Use

Office…93,117sqm (83.5%)
Commercial…18,114sqm (16.2%)
Others…286sqm(0.3%)
Parking…0 lots

Open: 1980



Mixed Index = 0.29



Ridership Performance in 2005	**Housing Pattern in 2001**
Weekly Pax… 792,249 (1.1%up since 01')	Housing Units within 500m….. 3,422units
Weekday-Weekend Balance… 1.91	Spatial Pattern
Weekday AM Peak Balance… 0.30	500-200m…87.1%
Weekday PM Peak Balance… 0.62	200-0m…12.9%
Weekday AM-PM Peak Balance… 1.02	Private Housing Share.…. 100.0%
Travel Time to Central…. .2minutes	

Table A2.1.2. Admiralty (HO) Survey Sheet

Date/Time	May 14, 2007 / 5::00pm-			
Path	1	2	3	T
Destination	Citic Tower	Mall & Office	Government Office	PTI
Walking Distance m	400	10-50 (Vertical)	400	10
Linear Distance m	350	10-50 (Vertical)	350	10
Walkng Time Min.	10	2	10	2
Indoor % ---------------- Structure Type	95 ---------------- Roofed Bridge	100 ------------------ Building	100 ------------------ Shelter Bridge & Buildings	100 ------------------ Building
#: Up-Down ---------------- Mechanized?	1 ---------------- Yes	Vertical ---------------- Yes	2 ---------------- Yes	1 ---------------- Yes
Width Cm	400	400	400-600	400
#: Retails ---------------- Advertisement	0 ---------------- 0	Many ------------------ 0	Many ------------------ Many	0
Signage # & Type	1 ---------------- Private	Many ---------------- Private	Many ---------------- Public & Private	Many ---------------- Public & Private
Design & Amenity	Small Plant	Retail Activities	New Building Interior / Spacious	Functional
Sidewalk Type	Footbridge	Building	Building & Shelter Bridge	Normal & Building
Separation From Auto	Full	Full	Full	Full
Interchange #	0	0	0	0
Interchange Waiting Time	0	0	0	0
Note	Long Footbridge, Green pocket	One of the integrated four buildings	A big footbridge to the Pacific Place over Queensway	Integrated with MTR station

A2.2 Tin Hau (HR)

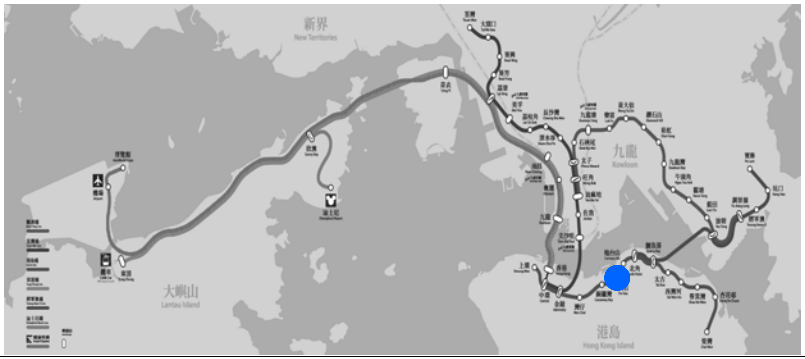
Figure A2.2.1. Tin Hau (HR) Catchment Area Map

 Residential Tower on MTR	 Exit A1	 PTI at the Ground Level
 Exit B	 Public Signage System	 Integrated Big Parking
 Green Pocket near Exit A1, A2	 Sidewalk to Public Library	 Old Retail Street

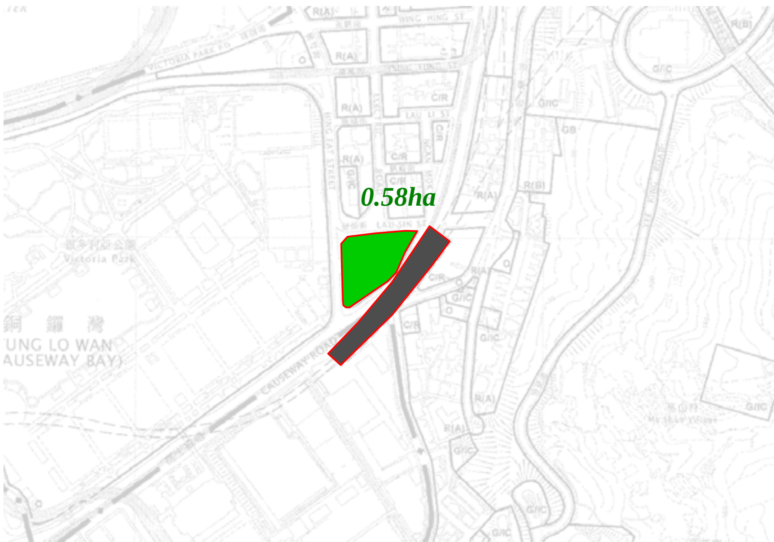
Figure A2.2.2. Tin Hau (HR) Catchment Area Photos

Table A2.2.1. Tin Hau (HR) Case Summary Sheet

Location Map



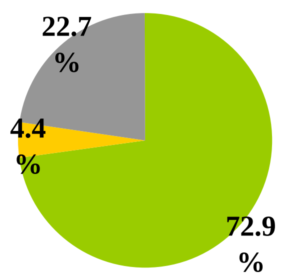
Site Map



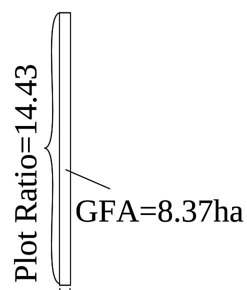
R+P Land Use

Residential… 61,000sqm(72.9%)
Commercial… 3,700sqm(4.4%)
Others… 19,000sqm(22.7%)
Parking… 650lots

Open: 1989



Mixed Index = 0.44



Site Area=0.58ha

Ridership Performance in 2005

Weekly Pax… 232,369 (14.1%up since 01')
Weekday-Weekend Balance… 1.57
Weekday AM Peak Balance… 0.97
Weekday PM Peak Balance… 0.92
Weekday AM-PM Peak Balance… 0.98
Travel Time to Central… 8minutes

Housing Pattern in 2001

Housing Units within 500m… 13,137units
Spatial Pattern
- 500-200m… 57.5%
- 200-80m… 28.6%
- 80-0m… 13.9%

Private Housing Share… 79.6%

Table A2.2.2. Tin Hau (HR) Survey Sheet

Date/Time	May 14, 2007 / 4:35pm-				
Path	1	2	3	4	T
Destination	Residential Area	Public Library	Park	Retail Street	PTI
Walking Distance m	5	350	20	500	10
Linear Distance m	5	300	15	400	10
Walkng Time Min.	0.5	7	1	8	0.5
Indoor % Structure Type	0% ----------------- Open	20% ----------------- Roofed Bridge	0% ------------------ Open	0% ------------------ Open	0% ------------------ Open
#: Up-Down Mechanized?	1 ---------------- Yes	1 ---------------- Yes	0 ----------------	0 ----------------	0 ---------------
Width cm	300-500	250	250	250	200
#: Retails Advertisement	0	0	0	Many	0
Signage # & Type	0	2 ----------------- Public	1 ----------------- Public	0	0
Design & Amenity	Plants & Open Space	Trees, Green , & Well-paved	Old Noisy Street	Functionally Well Integrated	Plants & Open Space
Sidewalk Type	Normal	Normal & Footbridge	Normal	Normal	-
Separation From Auto	Yes	Yes	Almost	Not clearly	Yes
Interchange #	0	1	1	5	0
Interchange Waiting Time	0	30s	30s	2min	0
Note	Integrated with MTR, but Not direct connection	Large park	Next to MTR	Old Street	Integrated with MTR

A2.3 Hang Hau (MR)

Figure A2.3.1. Hang Hau (MR) Catchment Area Map


MTR and R+P Residential Area


Integrated R+P Residential Area

Integrated Entrance

Entrance and Security Check Point


Open Space and Club House


Club House


Club House Open Space


Club House Childcare Space


Footbridge


Private Signage System


Walkway passing through Retail Buildings


Public Housing – Open Space


Public Housing


Public Housing Retail Mall

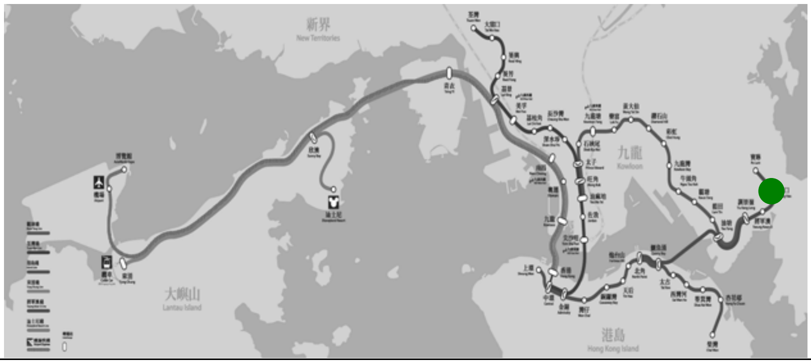

TKO Hospital

		
Town Square and Integrated point from outside	PTI - inside	PTI - outside

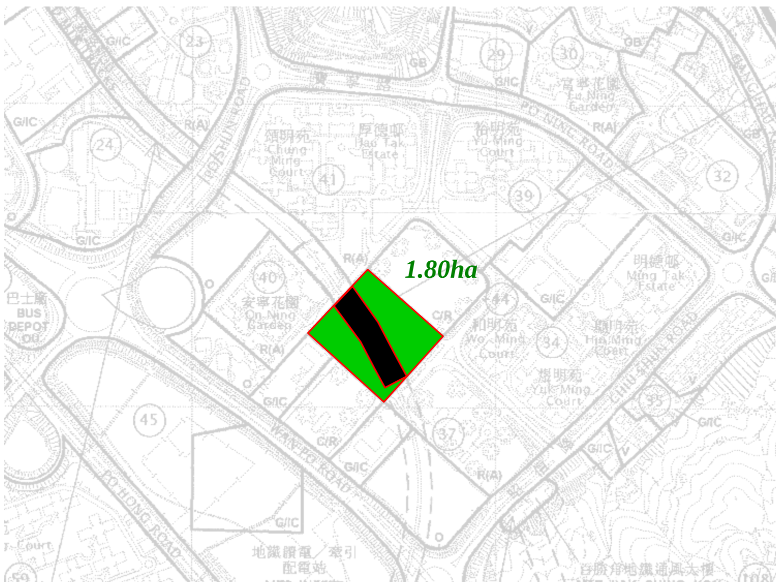
Figure A2.3.2. Hang Hau (MR) Catchment Area Photos

Table A2.3.1. Hang Hau (MR) Case Summary Sheet

Location Map



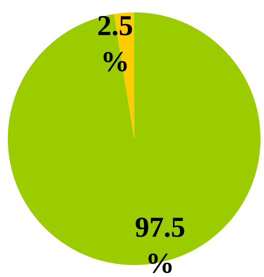
Site Map



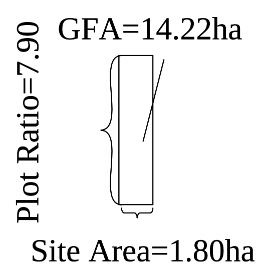
R+P Land Use

Residential… 138,652sqm(97.5%)
Commercial… 3,500sqm(2.5%)
Parking… 369lots

Open: 2005



Mixed Index = 0.07



Ridership Performance in 2005

Weekly Pax… 635,156 (100%up since 01')
Weekday-Weekend Balance… 1.42
Weekday AM Peak Balance… 0.39
Weekday PM Peak Balance… 0.62
Weekday AM-PM Peak Balance… 1.31
Travel Time to Central… 26minutes

Housing Pattern in 2001

Housing Units within 500m… 31,196units
Spatial Pattern
500-200m… 31.1%
200-80m… 55.6%
80-0m… 13.3%
Private Housing Share… 20.6%

Table A2.3.2. Hang Hau Survey Sheet

Date/Time	May 16, 2007/ 2:00pm-				
Path	1	2	3	4	T
Destination	TKO Hospital	Public Housing (Hau Tak)	East Point City (Mall)	Residential Oasis- R+P with Club House	PTI
Walking Distance m	500	150	10	10	10
Linear Distance m	400	100	10	10	10
Walkng Time Min.	10	3	0.5	0.5	0.5
Indoor % Structure Type	60 ------------------ Building	100 ----------------- Building	100 ----------------- Building	100 ------------------ Integrated	100 ------------------ Integrated
#: Up-Down Mechanized?	1 ---------------- Yes	0 ----------------	0 ----------------	1 ---------------- Yes	1 ---------------- Yes
Width Cm	300-500	300-500	300-500	400	400
#: Retails Advertisement	Many	Many	Many	0	0
Signage # & Type	Many ----------------- Private	Many ----------------- Private	1 ---------------- Private	A Few ---------------- Private	0
Design & Amenity	Retail Activities & Public Open Space	Retail Activities	Retail Activities	High-End Comfortable Space	Integrated and Functional
Sidewalk Type	Building & Normal	Building & Normal	Sheltered Footbridge	Direct	Direct
Separation From Auto	Almost Full	Full	Full	Full	Full
Interchange #	1	0	0	0	0
Interchange Waiting Time	30s	0	0	0	0
Note	The Regional Hospital is located far from station	Pedestrians pass through the retail center	Pedestrians directly enter the retail center	Residential area is integrated with MTR station	Integrated with MTR station

A2.4 Tung Chung (LR)

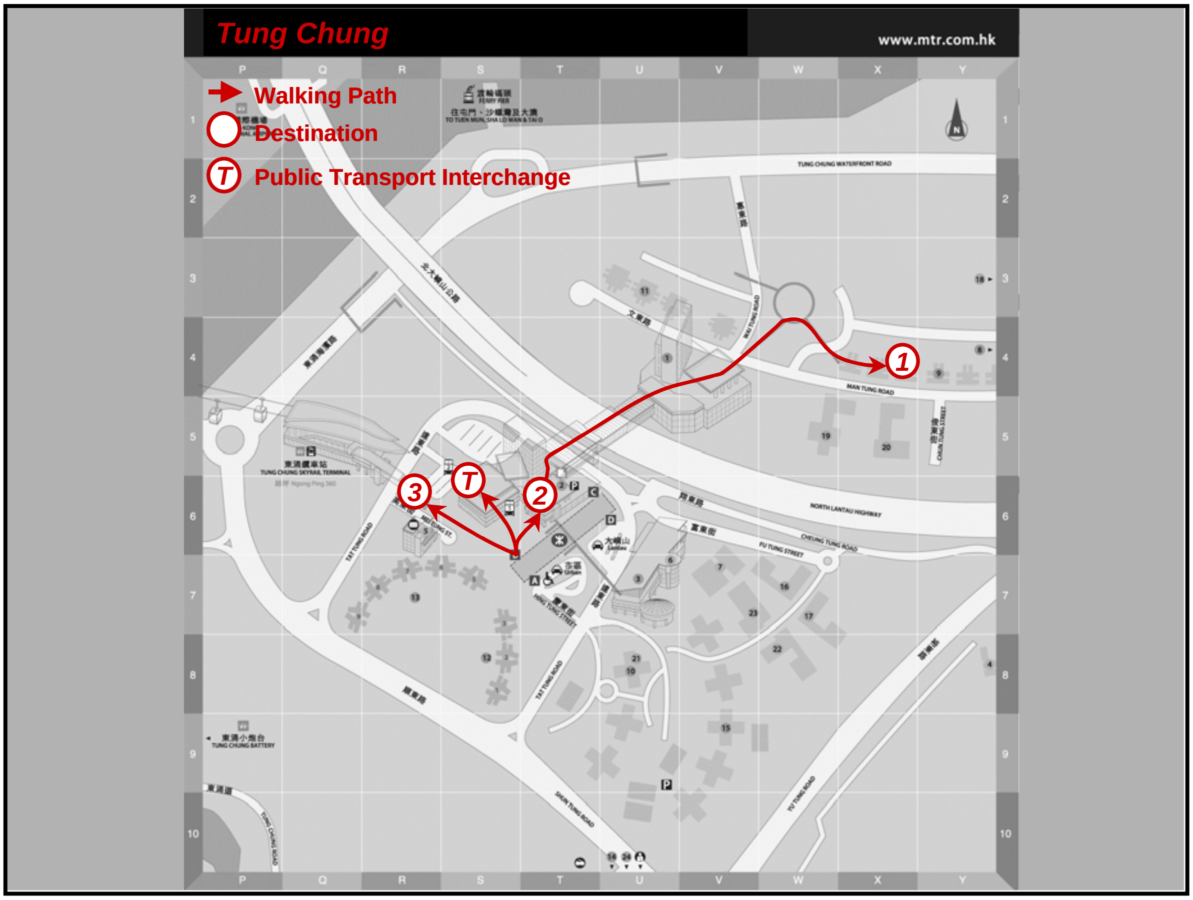


Figure A2.4.1. Tung Chung (LR) Catchment Area Map

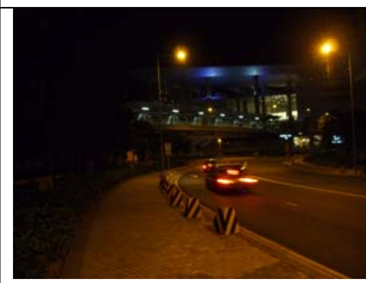
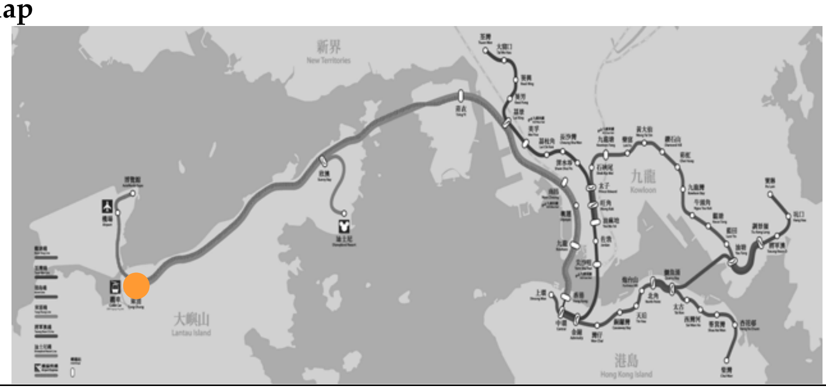
 Residential Area	 Town Square	 Shopping Mall and MTR (Nighttime)
 Inside Shopping Mall (Up & Down)	 Big Footbridge with Retails	 Private Signage System
 Footbridge Network to the Residential Area (Nighttime)	 Footbridge to the Residential Area (Nighttime)	 Outside of the R+P area (Nighttime)

Figure A2.4.2. Tung Chung (LR) Catchment Area Photos

Table A2.4.1. Tung Chung (LR) Case Summary Sheet

Location Map

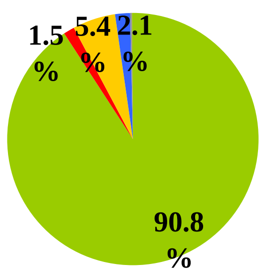


Site Map

R+P Land Use

Residential… 935,910sqm (90.8%)
Office…14,999sqm(1.5%)
Commercial… 55,862sqm(5.4%)
Hotel… 22,000sqm(2.1%)
Others…2,063sqm(0.2%)
Parking….. 3,869lots

Open: 1998



Mixed Index = 0.25

Plot Ratio=4.76

GFA=103.08ha

Site Area=21.70ha

Ridership Performance in 2005

Weekly Pax…359,123 (39.3%up since 01')
Weekday-Weekend Balance… 1.48
Weekday AM Peak Balance… 0.75
Weekday PM Peak Balance… 0.91
Weekday AM-PM Peak Balance… 1.32

Travel Time to Central… 35minutes

Housing Pattern in 2001

Housing Units within 500m… 5,815units
Spatial Pattern
500-200m… 0.00%
200-80m… 0.00%
80-0m… 100.00%
Private Housing Share… 26.7%
*2001 Census Data does not capture the R+P developments.

Table A2.4.2. Tung Chung Survey Sheet

Date/Time	May 16, 2007 / 2:00pm-			
Path	1	2	3	T
Destination	Residential Area (Coastal Skyline)	Shopping Mall	Cable Car Station	PTI
Walking Distance m	400	20	200	15
Linear Distance m	350	20	150	15
Walkng Time Min.	7	2	5	1
Indoor % Structure Type	100 ------------------ Bridge	50 ------------------ Building	0 ------------------ Building	0 ------------------
#: Up-Down Mechanized?	2 ---------------- Yes	1 ---------------- Yes	2-3 ---------------- Yes	0 ----------------
Width Cm	400-2000	Town Square	500-2000	Town Square
#: Retails Advertisement	Many ----------------- Yes	0 -----------------	0 -----------------	0 -----------------
Signage # & Type	Many ----------------- MTR, Private	1 ----------------- MTR	1 ---------------- Public	1 ---------------- MTR
Design & Amenity	Commercial Activities, Spacious	Through well designed Town Square	Very Spacious	Well Designed Town Square
Sidewalk Type	Building and Bridge	Town Square	Town Square and Normal	Direct
Separation From Auto	Full	Full	Full	Full
Interchange #	0	0	0	0
Interchange Waiting Time	0	0	0	0
Note	Very Spacious Bridge with Retails, Safe during night hours	Across the Town Square	Across the Town Square	Across the Town Square

A2.5 Hong Kong (LM)

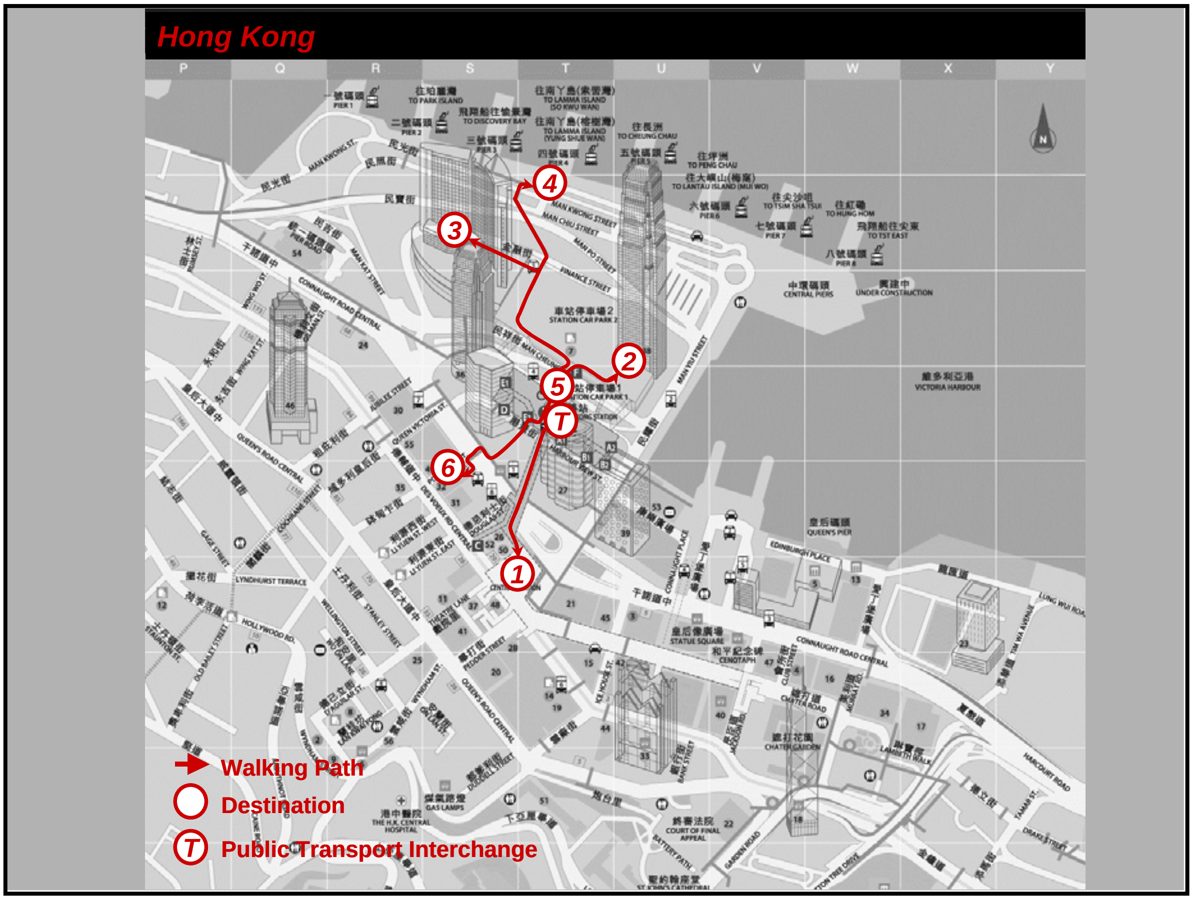


Figure A2.5.1. Hong Kong (LM) Catchment Area Map

 1-IFC, 2-IFC and the Four Season Hotel	 Underground Transfer Corridor to/from Central	 Underground Art Space
 Airport Line Gate (multiple layers)	 Taxi Lines in front of the Airport Gate	 Airport Check-in Counter
 Functional Signage System at the Ground Level	 PTI at the Ground Level	 Vertical Movement

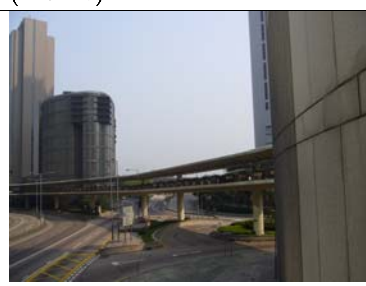
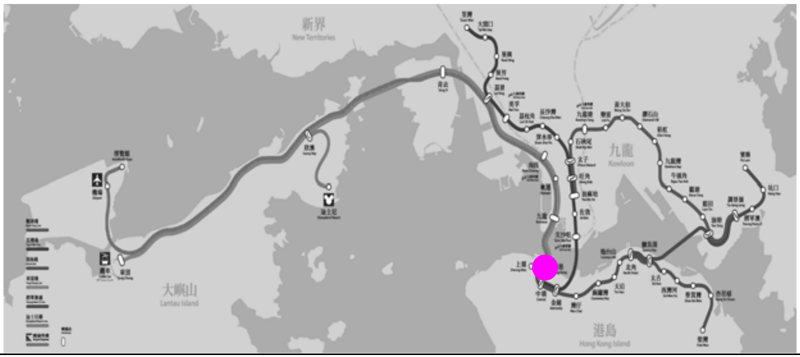
 Shopping Corridor at the Second Floor Level	 Footbridge to/from the Ferry Piers	 Open View at the Second Floor Level
 Integrated Hotel	 High-End Retails to the Hotel (Inside)	 Pedestrian Deck from MTR to the Private Properties
 Bridge Connections at the Second Floor Level	 Footbridge Network around MTR	 Public Open Space (POS) on the Roof

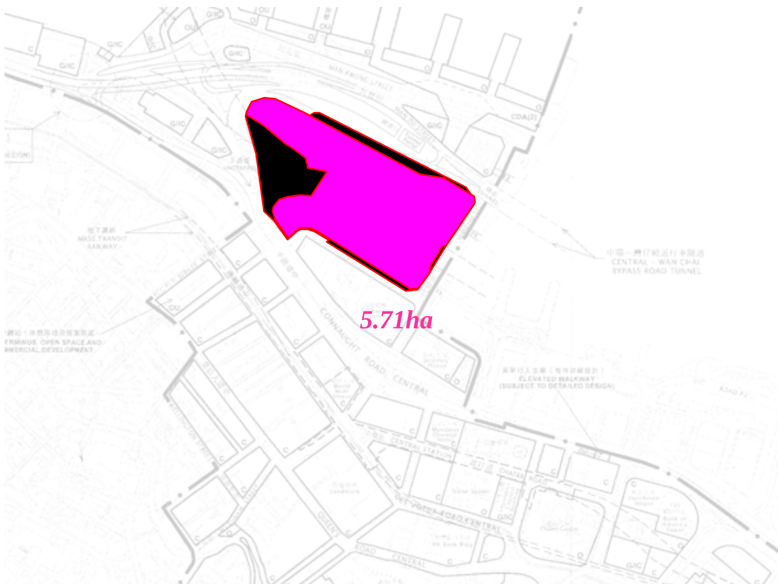
Figure A2.5.2. Hong Kong (LM) Catchment Area Photos

Table A2.5.1. Hong Kong (LM) Case Summary Sheet

Location Map



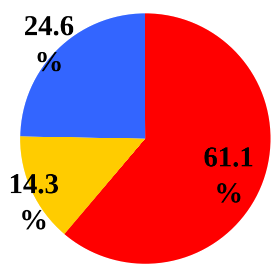
Site Map



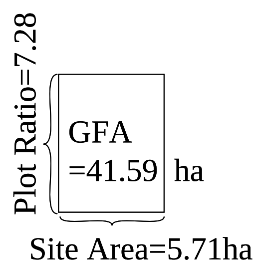
R+P Land Use

Office…254,186sqm(61.1%)
Commercial… 59,458sqm(14.3%)
Hotel… 102,250ha(24.6%)
Parking… 1,344lots

Open: 1998



Mixed Index = 0.57



Ridership Performance in 2005

Weekly Pax… 467,720 (34.5%up since 01')
Weekday-Weekend Balance… 1.83
Weekday AM Peak Balance… 0.50
Weekday PM Peak Balance… 0.55
Weekday AM-PM Peak Balance… 1.15
Travel Time to Central…8minutes

Housing Pattern in 2001

Housing Units within 500m… 2,707units
Spatial Pattern
500-200m…53.5%
200-0m…46.5%
Private Housing Share.…. 100.0%

Table A2.5.2. Hong Kong Survey Sheet

Date/Time	May 16, 2007 / 4:00pm-						
Path	1	2	3	4	5	6	T
Destination	Central Station	IFC Shopping & Office	Four Season Hotel	Ferry Piers	Check-in Facilities	Other Office Buildings	PTI
Walking Distance m	300	30	100	300	15	100-300	15
Linear Distance m	250	30	50	250	15	100-300	15
Walkng Time Min.	7	3	5	7	2	5	2
Indoor % Structure Type	100 Underground Corridor	100 Building	100 Building	90 Building +Bridge	100 Building	90 Building +Bridge	100 Direct
#: Up-Down Mechanized?	0 Yes	2-3 Yes	2-3 Yes	1 Yes	1 Yes	1-2 Yes	1 Yes
Width Cm	500-1000	300-500	300-500	300-500	500-1000	300-500	300-500
#: Retails Advertisement	Many Yes	Many Yes	Many Yes	Many Yes	0 Yes	Some Yes	Some Yes
Signage # & Type	Many MTR	Many MTR +Private	Many Private	Many Private	Many MTR	Many MTR +Private	0 MTR
Design & Amenity	Art Space, Functional, and Retails	In IFC Commercial Activities	Commercial Activities	Green Space and Open Harbor View	Very Functional	Open Space and Functional	Open Space and Functional
Sidewalk Type	Corridor	Building	Building	Building & Footbridge	Building	Building & Footbridge	Direct
Separation From Auto	Full	Full	Full	Full	Full	Full	Full
Interchange #	0	0	0	0	0	0	0
Interchange Waiting Time	0	0	0	0	0	0	0
Note	High capacity underground walking corridor	Pedestrians vertically pass through the commercial floors by the travelator	Integrated, but not well connected	Two direct footbridges to/from IFC, which keep open air	Vertically well integrated	Long open footbridge network at the second floor level	Functionally integrated with MTR

Appendix 3

Quality of Catchment Area

Non-R+P Cases & Non-Station Cases

A3.1 Quarry Bay (Non-R+P Case: Office)

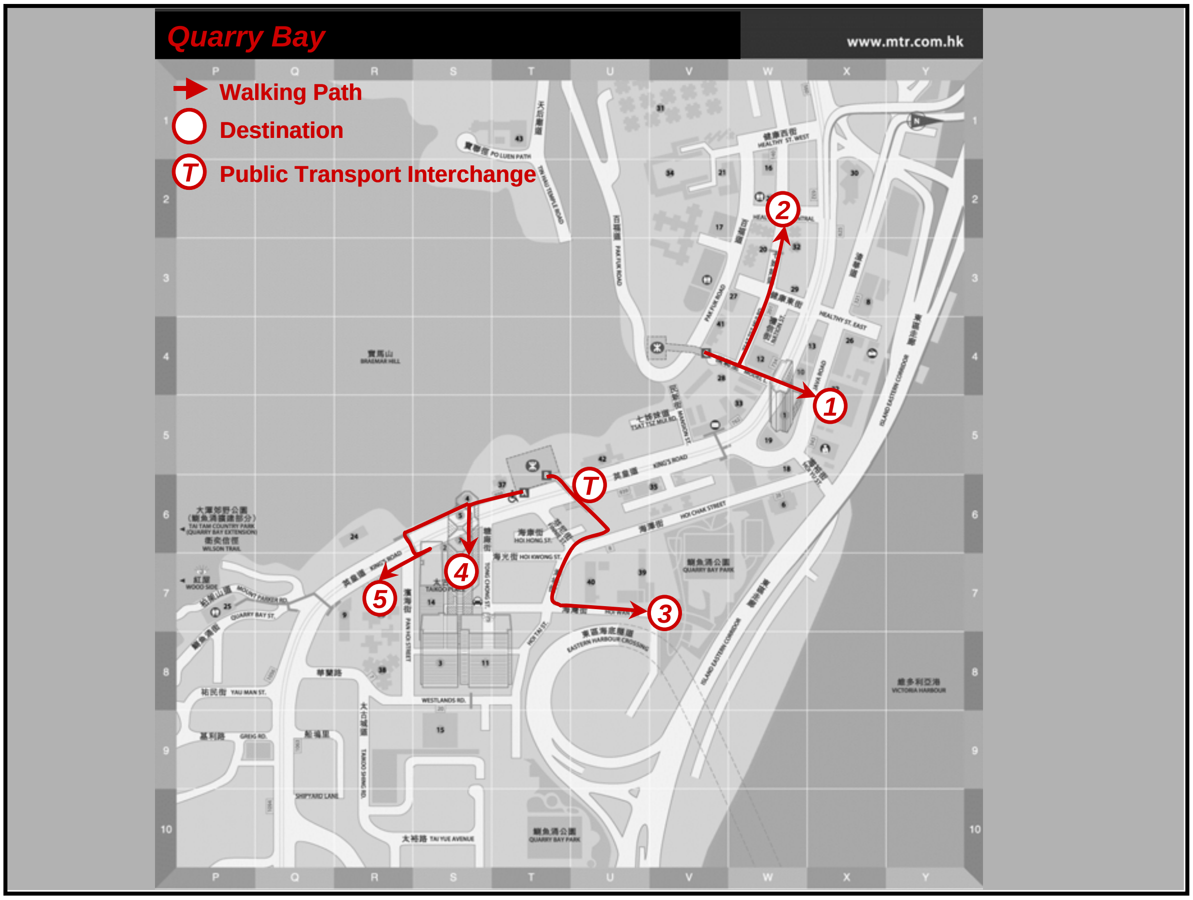


Figure A3.1.1. Quarry Bay Catchment Area Map

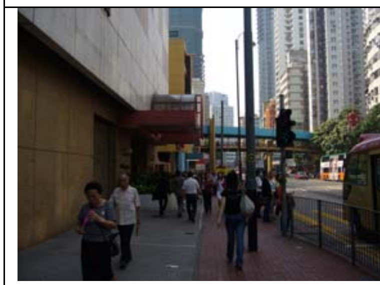
 Corridor – Exit C	 Entrance/Exit C	 Around Exit C
 Pedestrians: Exit A	 Exit B	 Walking Environments from MTR to the Market Place
 Signage System	 Bridge from the Private Property	 Bridge from/to the Old Market District

Figure A3.1.2. Quarry Bay Catchment Area Photos

Table A3.1. Quarry Bay Survey Sheet

Date/Time	May14, 2007 / 2:35pm-					
Path	1	2	3	4	5	T
Destination	North Point Government Offices	Market Center	Quarry Bay Park	Taikoo Place (Major Private Bld.)	Old Retail District	Bus Bay
Walking Distance m	200	400	500	150	300	100
Linear Distance m	200	350	250	100	250	50
Walkng Time Min.	7	12	15	7	3	7
Indoor % / Structure Type	40 / Corridor	20 / Corridor	25 / Roofed Bridge	50 / Sheltered Bridge	30 / Roofed Bridge	100 / Roofed Bridge
#: Up-Down / Mechanized?	1 / No	1 / No	2 / Yes	1 / Yes	2 / No	2 / Yes & No
Width Cm	200-	200-	200-	300-400	200-	200-500
#: Retails / Advertisement	5 / 0	20-30 / 0	10 / 0	2 / 0	2 / 0	0 / 0
Signage # & Type	1 / MTR	0	0	2 / Private	0	1 / MTR
Design & Amenity	No	No	No	Small Plant Clean (Bridge Part)	No	No
Sidewalk Type	Normal Both sides	Normal Both sides	Normal & No Sidewalk	Normal & Bridge	Normal & Bridge	Bridge
Separation From Auto	No Heavy Traffic Disturbing	No Heavy Traffic Disturbing	No Heavy Traffic Disturbing	Full	Full	Full
Interchange #	2	2	2	0	0	0
Interchange Waiting Time	1-2min	30s	2-4	0	0	0
Note	Too many commercial vehicles	Old retail activities, noisy and many taxis and trucks	Mainly for passive uses	Private property tries to keep access to MTR station. A half of the way is comfortable due to the private bridge.	Old and noisy district. I saw that informal hair salon was opened on the bridge	Direct connection to the bus bay

A3.2 Ngau Tau Kok (Non-R+P Case: Residential)

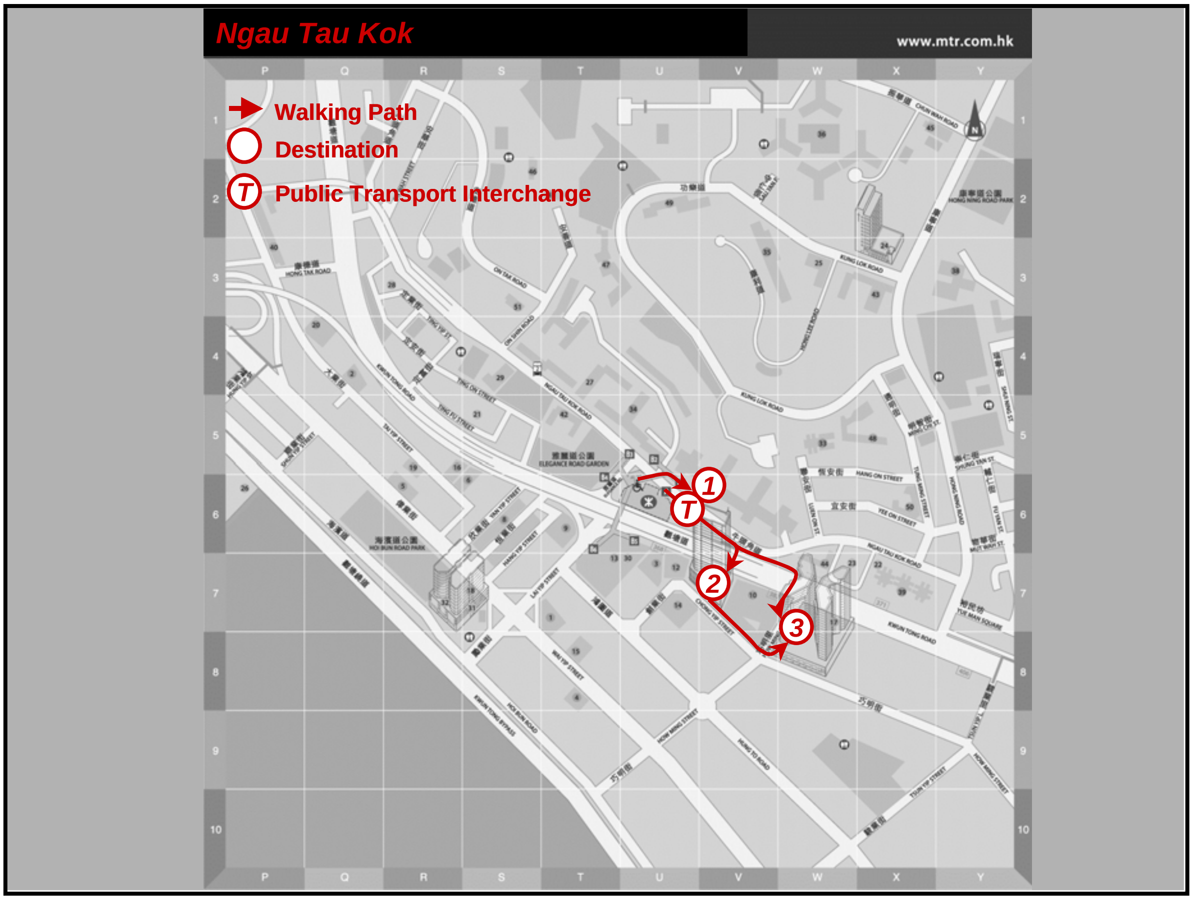


Figure A3.2.1. Ngau Tau Kok Catchment Area Map

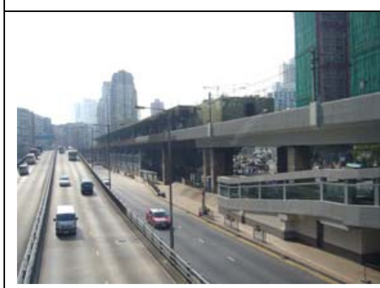
 MTR and Bus Bay	 Entrance of the Underground Path Network	 Underground Path to the Residential Towers
 Public Signage System	 Walkway to the Bus Bay	 Footbridge from the Private Property
 MTR, Highway and Disconnected Footbridge	 Underground Path to the Camber of Commerce	 Inaccessible path at the ground level

Figure A3.2.2. Ngau Tau Kok Catchment Area Photos

Table A3.2. Ngau Tau Kok Survey Sheet

Date/Time	May 15, 2007 / 3:30pm-				
Path	1	2	3	4	T
Destination	Residential (Lotus Tower)	Office (Millennium City)	HK Camber of Commerce	HK Camber of Commerce (Another Path)	Bus Bay
Walking Distance m	30	100	150	150	10
Linear Distance m	15	70	100	100	10
Walkng Time Min.	4	7	10	10	1
Indoor % Structure Type	50 ------------------ Underground	35 ------------------ Footbridge	35 ------------------ Building	35 ----------------- Underground	0 -----------------
#: Up-Down Mechanized?	2 ---------------- No	2 ---------------- No	2 ---------------- No	2 ---------------- No	0 ----------------
Width Cm	300	200-300	200-300	200-300	300
#: Retails Advertisement	0 ----------------- Yes	3 -----------------	0 -----------------	0 -----------------	0 -----------------
Signage # & Type	2 ----------------- MTR	2 ----------------- Pub/Private	1 ---------------- Public	2 ---------------- MTR	1 ---------------- Public
Design & Amenity	Simple Underground Path	No Design	Private-based Footbridge	Simple Underground Path	Green Pocket
Sidewalk Type	Underground Path and Normal	Footbridge and Normal	Foot bridge Building and Normal	Underground Path and Normal	Normal (One side)
Separation From Auto	Full	Full	Almost Full	Full	Full
Interchange #	0	0	1	0	0
Interchange Waiting Time	0	0	1min	0	0
Note	Wide but not pleasant	Coming from one private property but not fully reached to MTR station.	Not really well coordinated	The old underground path is not pleasant	In front of MTR station

A3.3 Causeway Bay (Non-R+P Case: Office & Retail)

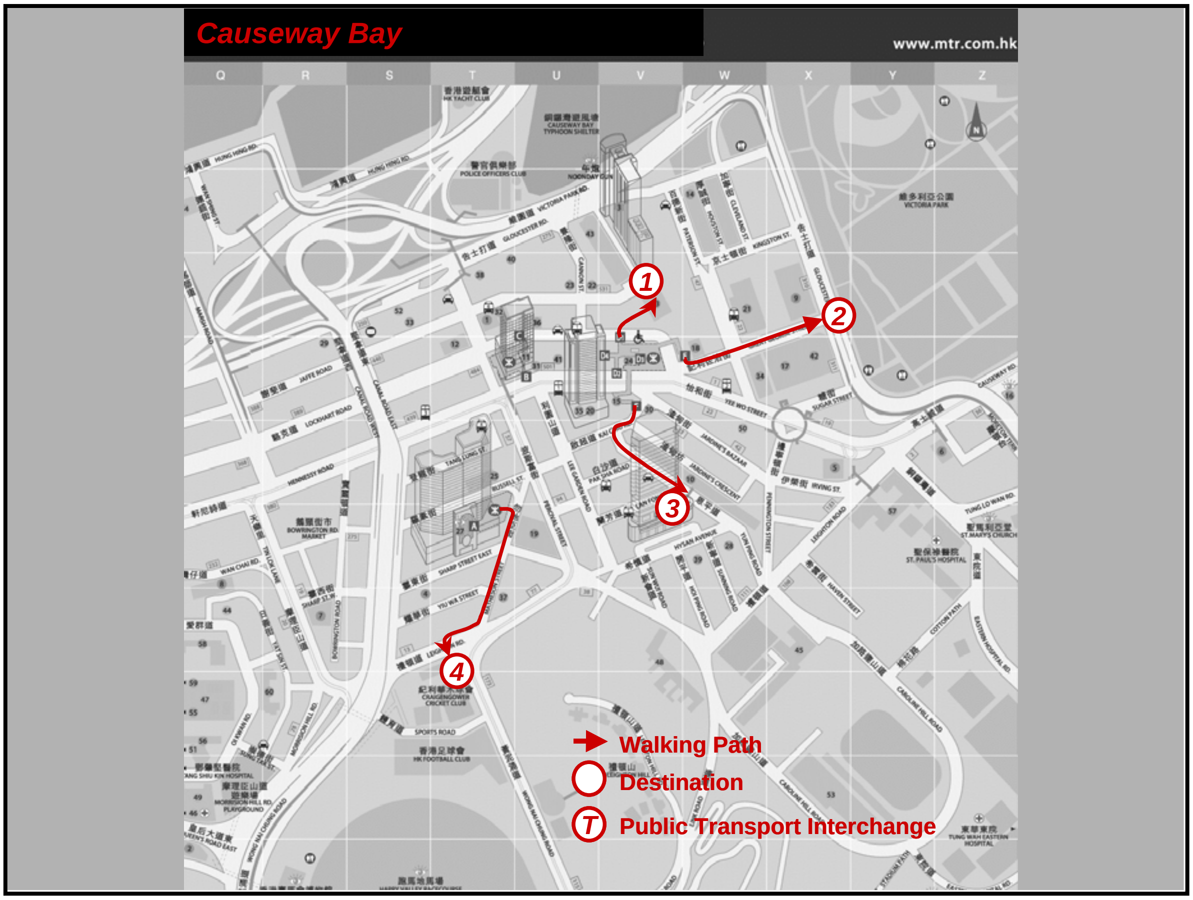


Figure A3.3.1. Causeway Bay Catchment Area Map

MTR Station Underground Space

Exit E-1

Retails, Sidewalk and Intersection

Public Signage System

Pedestrians at the ground level

Times Square at the ground level

Arcade

Limited Private Vehicle Access

Construction on the street

Figure A3.3.2. Causeway Bay Catchment Area Photos

Table A3.3. Causeway Bay Survey Sheet

Date/Time	May 16, 2007 / 1:20pm-			
Path	1	2	3	4
Destination	Excelsior Hotel	Victoria Park	Lee Garden	Happy Valley
Walking Distance m	50	150	300	300
Linear Distance m	30	150	200	250
Walkng Time Min.	3	5	10	10
Indoor % Structure Type	50 ------------------ Roof	0 ------------------	0 ------------------	0 ------------------
#: Up-Down Mechanized?	0 ----------------	0 ----------------	0 ----------------	0 ----------------
Width Cm	200-500	300	200-300	200-300
#: Retails Advertisement	Many -----------------	Many -----------------	Many -----------------	Many -----------------
Signage # & Type	1 ----------------- Public	2 ----------------- Public	3 ----------------- Public	3 ----------------- Public
Design & Amenity	Dense Retail Activities	Dense Retail Activities	Dense Retail Activities	
Sidewalk Type	Retail Arcade	Normal	Normal	Normal
Separation From Auto	No	No	No	No
Interchange #	1	2	3	3
Interchange Waiting Time	10sec	3min	30sec	2min
Note	Very crowded and no directional at the ground level	Very crowded and no directional at the ground level	Very crowded and no directional at the ground level but private car use is limited	Not so crowded but there are some minor constructions on the streets.

A3.4 East Tsim Sha Tsui (Non-Station Case: Urban)

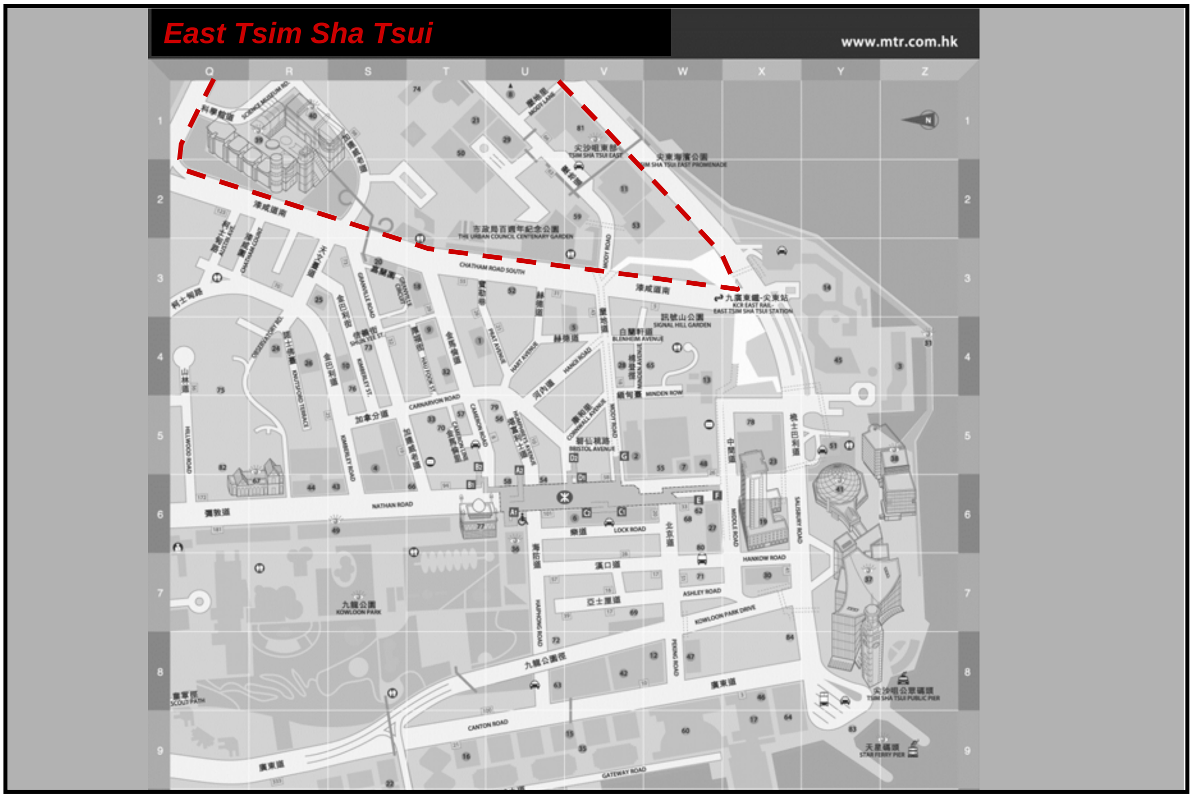


Figure A3.4.1. East Tsim Sha Tsui Development Area Map

Open Space

Open Space 2

Retails and Walking

Wide Street

Commercial Vehicle Access

KCR Station

Figure A3.4.2. East Tsim Sha Tsui Development Area Photos

A3.5 South Horizons (Non-Station Case: Suburban)

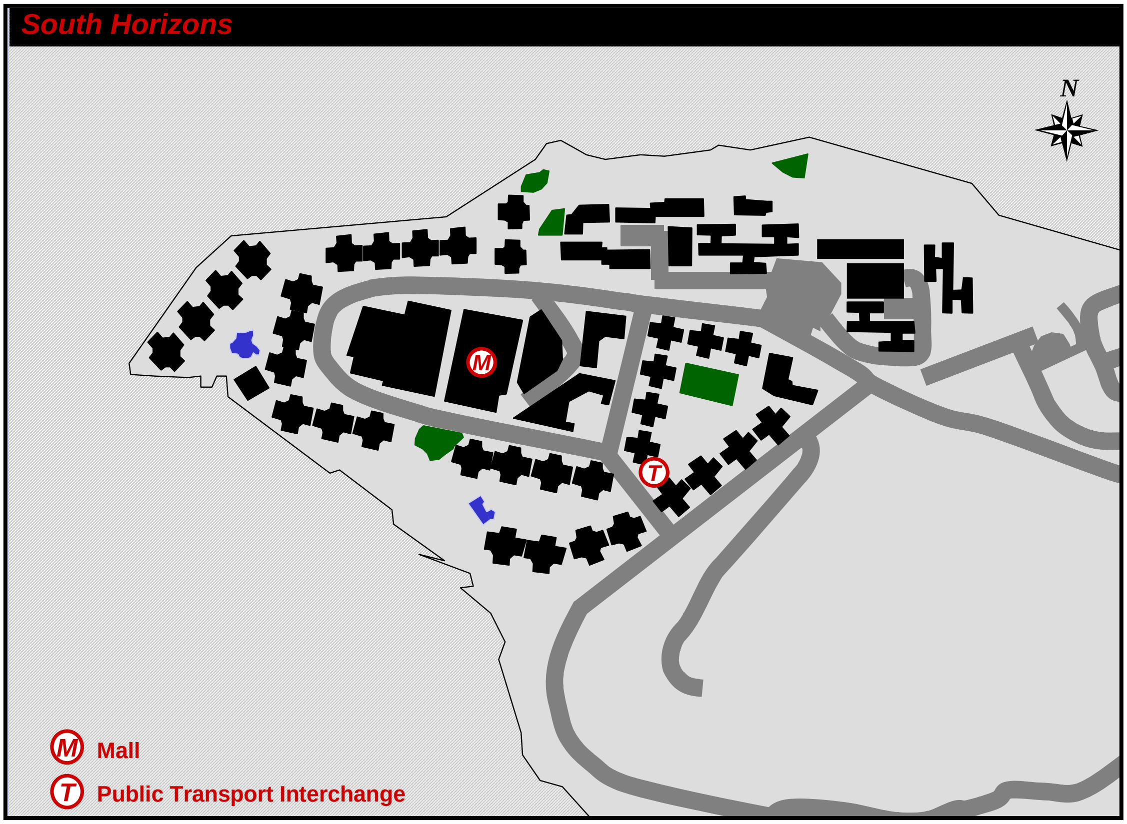


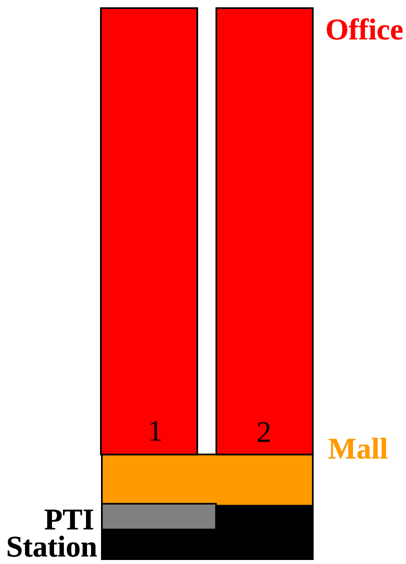
Figure A3.5.1. South Horizons Development Area Map

 Main Bus Terminal	 Residential Towers	 District Center (Mall)
 Community Park	 Oceanside Residential Tower and Walkway	 Bus Stops and Intra-Community Circulation

Figure A3.5.2. South Horizons Development Area Photos

Appendix 4
Partnership Models

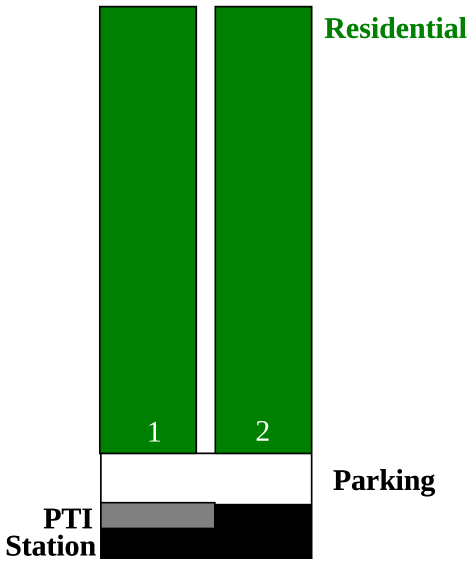
A4.1 Admiralty (HO): 1980-



	Office	Mall	Public Transport Interchange
1. Construction	Developer based on railway/development coordinated design and enabling works provided by MTRC		
2. Mechanism of sharing cost / profit	- Developer paid land premium and development cost - Investment return split by end-profit sharing		Conditions in land grant
3. Ownership of Asset	Multiple owners	Multiple owners	Government
4. Management	MTRC	MTRC	Government delegated to operator

Figure A4.1. Admiralty (HO) Partnership Diagram

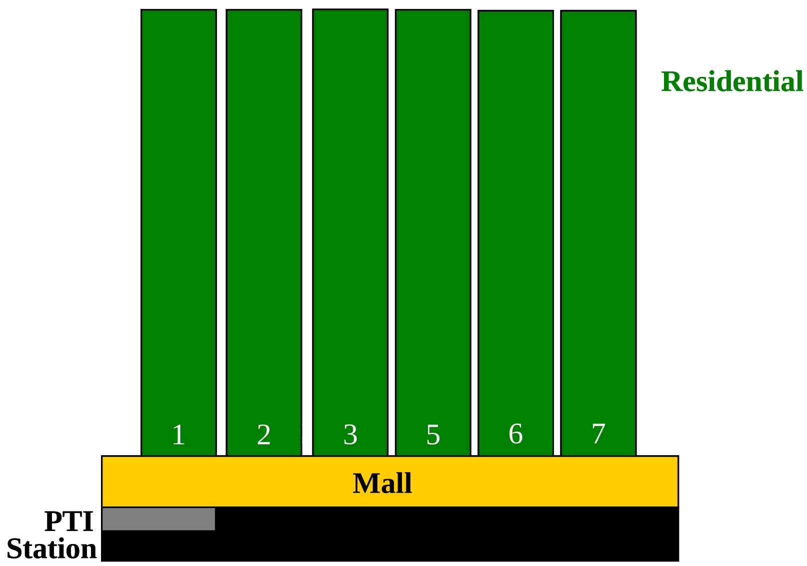
A4.2 Tin Hau (HR): 1989-



	Residential Towers	Public Car Park	Public Transport Interchange
1. Construction	Developer based on railway/development coordinated design and enabling works provided by MTRC		
2. Mechanism of sharing cost / profit	- Developer paid land premium and development cost - Investment return split by end-profit sharing	Conditions in land grant	
3. Ownership of Asset	Individual flat owners	Government	
4. Management	MTRC delegated to management company	Government delegated to operator	Government delegated to operator

Figure A4.2. Tin Hau (HR) Partnership Diagram

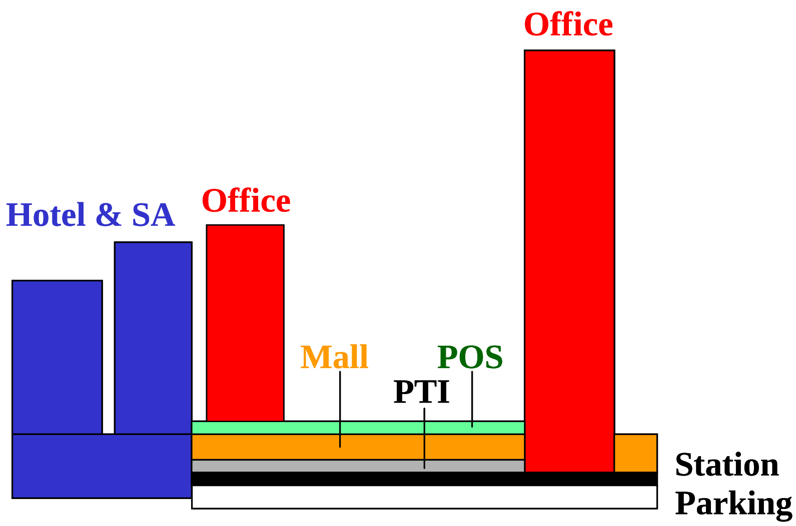
A4.3 Hang Hau (MR): 2005-



	Residential Towers	Mall	Public Transport Interchange
1. Construction	Developer based on railway/development coordinated design and enabling works provided by MTRC		
2. Mechanism of sharing cost / profit	- Developer paid land premium and development cost - Investment return split by end-profit sharing and sharing in kind		Conditions in land grant
3. Ownership of Asset	Individual flat owners	MTRC	Government
4. Management	MTRC	MTRC	Government delegated to operator

Figure A4.3. Hang Hau (MR) Partnership Diagram

A4.4 Hong Kong (LM): 1998-



	Office	Mall	Serviced Apartment & Hotel	Roof Garden (Public Open Space)	Public Transport Interchange
1. Construction	Developer based on railway/development coordinated design and enabling works provided by MTRC				
2. Mechanism of sharing cost / profit	- Developer paid land premium and development cost - Investment return split by sharing in kind			Conditions in land grant	
3. Ownership of Asset	MTRC, Developer and Hong Kong Monetary Authority	Developer		Common area of all owners	Government
4. Management	1IFC – Developer 2IFC – MTRC	Developer	Hotel operator	MTRC delegated to developer	Government or dedicated operator

Figure A4.4. Hong Kong (LM) Partnership Diagram