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Urban Development on Railway-Served Land: Lessons and Opportunities for the Developing World

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1. Introduction

Theory and experiences show that, under the right conditions, rail transit investments can powerfully shape cities and regions. Among the "right conditions" are serious traffic congestion, a permissive regulatory environment, and frequent and reliable transit services. Traffic congestion is a pre-condition because only then can rail services – especially on dedicated and grade-separated rights-of-way – provide travel time savings relative to the private car. Zoning and other regulatory tools must also be in place to allow building densities to be stacked up in and around rail stations. And services must be dependable if transit is to appeal to car-owning, choice consumers.

Part of the reason for rail transit's city-shaping powers is due to market forces and part due to policy interventions. By enhancing accessibility – the ability of those living, working, or shopping rail near stops to quickly reach desired destinations – rail services increase the value and desirability of properties in and around stations. There is, however, a limited, finite supply of parcels with superior accessibility in any city. To the degree a rail investment confers accessibility benefits, market pressures to intensify development around rail stations raise land values. Effectively, the accessibility benefits get capitalized into the price of land. This is not automatic, however. In some cities of the developing world, like Mexico City, development has often turned its back on metro stations in commercial districts. This has sometimes been due to the dis-amenities associated with the informal economy – e.g., street vendors, illicit activities (perceived or real), and casual labor who often congregate in busy areas like station areas. Class divisions and security concerns can mean lower density gradients in and around stations.

Market pressures by themselves rarely produce what is commonly referred today as Transit Oriented Development, or TOD (Calthorpe, 1993; Bernick and Cervero, 1997; Cervero et al., 2004). To leverage private investments in and around station, pro-activism and a certain amount of risk-taking on the part of local governments are often needed. Supportive and complementary activities – such as permissive zoning, under-writing of land costs, help with land assembly, and targeted infrastructure investments like sidewalks and lighting improvements in station areas – are particularly needed in marginal or stagnant urban districts where market demand for new development is weak.

2. Rail Infrastructure and Growth Impacts: Issues

One first issues encountered in addressing the development impacts of rail transit investment is whether they are generative or redistributive – i.e., do these investments create new and real economic growth (by enticing investments into a region that would otherwise not occur) or instead redistribute growth (e.g., from one part of a region un-served by rail to another part of a region that is). Simple statistics reveal a positive association between public transit investments and regional income. Data on 52 global cities from the *Mobility in Cities Database* of the UITP (International Association of Public Transport, 2006) shows a moderately

strong and positive association between Gross Domestic Product (GDP) and investments in public transport expressed on a per capita basis (Figure 1). While correlation does not mean causation, transport infrastructure appears to matter: GDP per capita trends upwards €63 for every Euro spent on public transport per inhabitant. This strong positive association of rail investments and services on economic performance likely reflects the dominance of European cities in the UITP database (46 of the 52 observations). Many European cities boast world-class railway systems matched by high ridership levels (Cervero, 1998). Only with high-quality rail services can the kinds of agglomeration economies be achieved that draws high valued-added, knowledge-based industries in finance, legal services, and professional consulting to the central city. Even in the U.S., studies show that in big, dense cities with robust and growing economies, rail-transit investments often yield high economic rates of return (Cambridge Systematics, Inc. and Apogee Research, 1996). Thus while some analysts (Giuliano, 2004; Forkenbrock, 2002) contend that the impacts of transport infrastructure tend to be more redistributive than generative, because rail systems support very high urban densities, the agglomeration benefits that occur from any spatial redistribution that might occur can be substantial, certainly more so than in the case of roads and highways. The high-rise financial districts of global hubs like New York City, Tokyo, Hong Kong, and London could not be sustained without rail services. There can be no doubt that the presence of rail has been both a prerequisite and a response to very dense urban agglomerations in such cities – i.e., they are co-dependent. And there can also be no doubt that more regional growth occurred due to the knowledge-based and service industries found in the downtowns of such rail-served cities than would have otherwise occurred and that resulting agglomeration economies have increased regional income and wealth. Thus while rail might strongly redirect where growth occurs in a region, the redistribution likely creates significant generative economic growth.

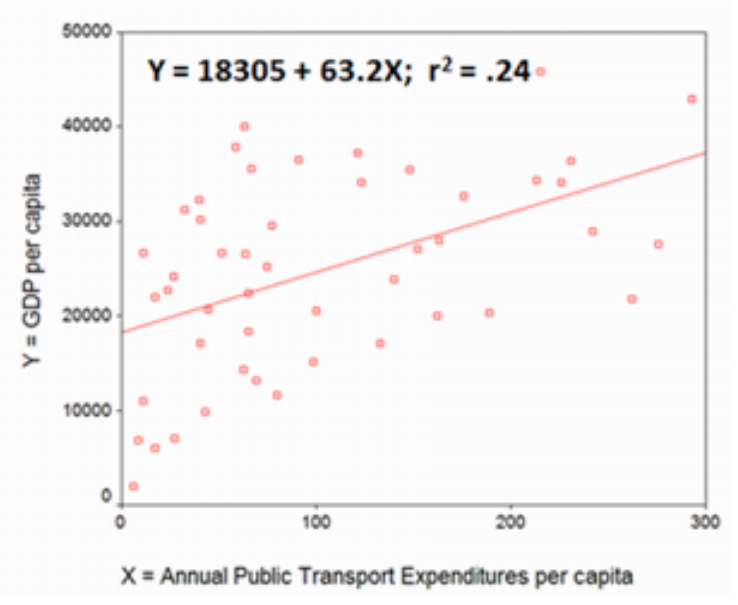

Figure 1. Scatterplots of GDP per capita (in Euros) and Annual Public Transport Expenditures per capita (including capital, operations, and maintenance), 51 Global Cities, 2001.

Another issue found in the literature on transport infrastructure and urban growth is whether investments are a lead or a lag factor. Do railway investments spur future urban growth or do investments tend to be targeted at areas experiencing rapid growth and increased traffic congestion? While no definitive study has been conducted on this question for rail transit, in the case of highway investments, the relationships are mixed. Numerous studies have shown highway investments induce building activities (Cervero, 2002), some work suggests the opposite also holds – one study, for example, showed that highway investments in metropolitan Chicago could be better explained by population growth rates a decade earlier than vice-versa (Urban Transportation Center, 1999). A related issue is whether rail investments "crowd-in" or "crowd-out" private investments – i.e., would as much regional economic growth occur in the tax dollars used to finance railway investments remain in the private sector? Conventional wisdom holds that in rapidly growth areas with strong real estate markets, "crowding in" is a stronger force (Cervero, 1998). What is unequivocal is the obverse: railway investments are incapable, by themselves, of turning around stagnant or lagging real estate markets.

While the accessibility benefits conferred by railway investments determines the degree to which land-use changes occur, accessibility is strongly influenced by the type of transit technology. Subways and other grade-separated, dedicated-right-of-way services enjoy speed advantages which for an expansive network mean high accessibility – i.e., the ability to reach numerous destinations quickly (particularly in comparison to the private car). However faster speeds are also due to rail's lower coefficient of friction, which when combined with rail's slower acceleration and deceleration typically results in longer station spaces. From a standpoint of land-use impacts, the combination of high regional connectivity and longer station spacing translates into denser, more nodal development than other transit mode (Figure 2). Mixed-traffic light-rail operations, in contrast, confer fewer travel-time savings relative to the car and thus fewer accessibility benefits. This in turn weakens market pressures to intensify uses around stops. And with Bus rapid transit (BRT), stops are often closer together (due to faster acceleration and deceleration of rubber-tired vehicles), which tends to contribute to more lineal patterns of growth – such as Curitiba (Figure 3).

3. Case Study Summaries: Land-Use Impacts of Heavy Rail Investments

Empirical evidence largely confirms theories about the land-use impacts of railway investments. This section first reviews experiences in North America, contrasting cases with proactive regional planning (Toronto, Canada) versus weak regional planning oversight (San Francisco Bay Area). America's most successful example of proactive integration of heavy rail and land development – Washington D.C.'s metrorail – is also reviewed. This is followed by two successful European cases of using heavy rail investments to channel growth according to a long-range regional land-use vision – notably, Copenhagen, Denmark and Stockholm, Sweden.

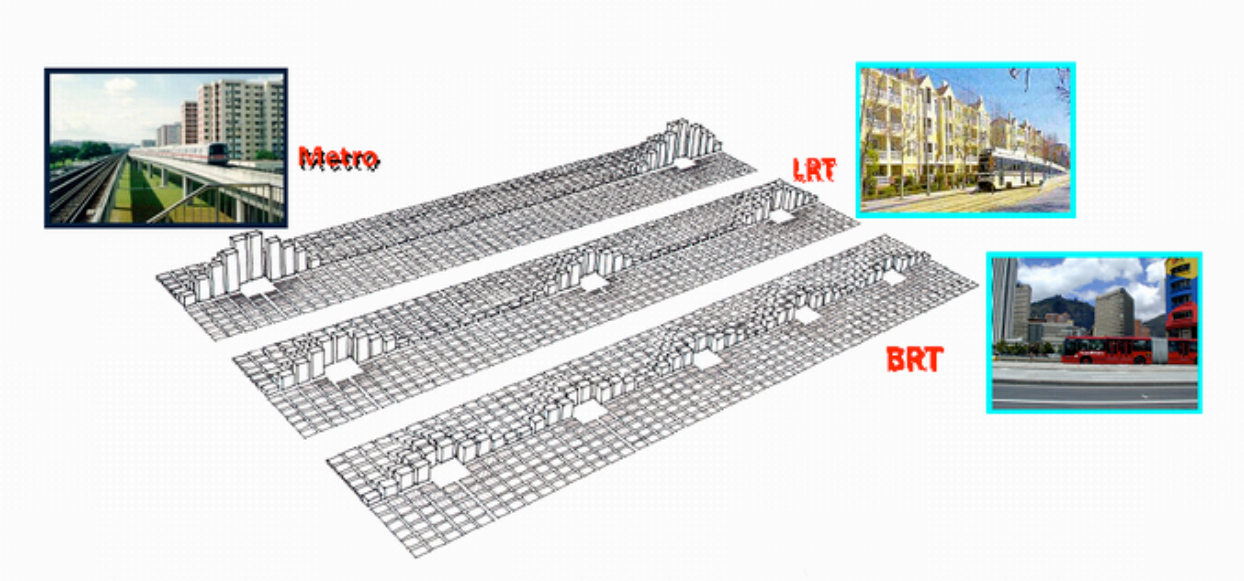

Figure 2. Relationship between Transit Technologies and Urban Development Patterns

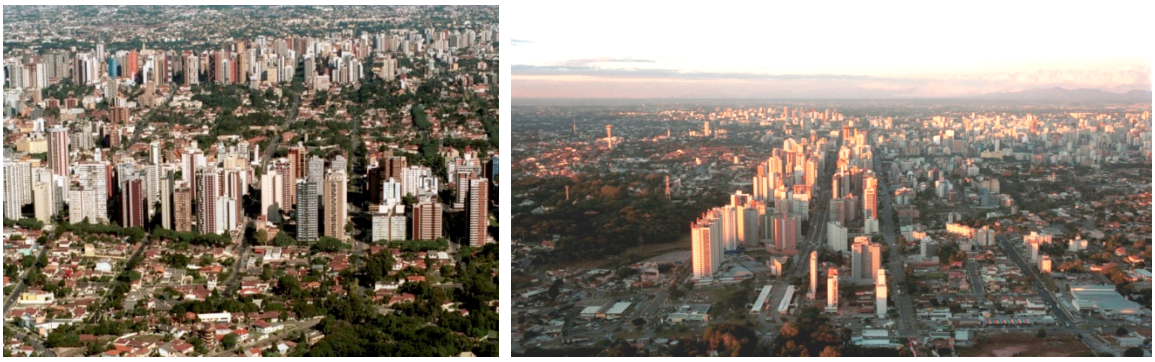

Figure 3. Lineal Development Patterns of Bus Rapid Transit, Curitiba, Brazil

3.1 Toronto: Leveraging a Metrorail Investment Through Pro-active Planning

Toronto, Canada, is often heralded as the best North American example of rail transit's city-shaping abilities. The urban-form impacts of the initial 24-kilometer subway system, opened over the 1954 to 1966 period, were immediate and dramatic. During the subway's first decade of operations, about one-half of high-rise apartments and 90% of office construction in the city of Toronto occurred within a five-minute walk of a train station (Heenan, 1968). The subway not only triggered the development of vacant or underused areas (some within a few kilometers of the city center), but it also spurred the recycling of decaying in-town commercial

buildings and blighted parcels.

One of the greatest accomplishments of Toronto's subway has been to strengthen the central business district (CBD) – partly a consequence of a radial, downtown-focused subway system but mainly a result of strategic regional land-use planning. Toronto's CBD has among the highest levels of employment and retail primacy in North America – i.e., very high shares of regional jobs and retail activities in the core. A strong CBD has in turned spawned high ridership levels – about 65% of all trips entering the CBD and historically well over 200 transit trips per capita per year, higher than in any U.S. metropolitan area, including greater New York. These outcomes are due in considerable part to the presence of a regional planning body (Metro) whose chief responsibility has been to orchestrate regional growth, in particular the co-development of railway services and land development.

Why has Toronto been so successful in making the transit-land use nexus work? The ingredients to Toronto's success were partly due to exogenous forces but primarily due to purposeful public policies (i.e., endogenous factors). The chief exogenous factor was good timing – notably, the subway investment coincided with a period of rapid growth (at its height, 45,000 new residents per year), meaning rail transit was well-positioned to shape where growth occurred. Additionally, many of the residents were low-skilled immigrants from abroad who were transit dependent (and were provided social housing sited near suburban rail stations). They tended to support the railway system at the fare box and the ballot box.

Carefully reasoned public policies, at both the federal and national levels, also contributed to the land-use successes of Toronto's railway investments. Federal tax laws, for example, do not allow home-owners to deduct mortgage interest payments and property taxes from income taxes, which has results in lower rates of single-family home-ownership. Similarly, Canada's national government does not sponsor freeway construction, as is the case in the U.S., which has resulted in fewer freeway lane-miles in Canadian cities than comparable size U.S. ones. Early freeway revolts further reduced the automobile's environmental footprint in Toronto. Without question, however, the one factor that best explains the subway's strong city-shaping impacts has been pro-active, coordinated land-use planning and management conducted by Toronto's metropolitan government. While zoning has always been controlled by individual municipalities in the region, the metro government retained veto powers over local land-use decisions that were inconsistent with the long-range transportation-land use plan. Among the initiatives introduced by the Metro government to leverage land development were density buses for parcels near rail stations, limits on park-and-ride construction at non-terminal stations, transferable development rights (that enabled densities to be stacked near rail stations), and supplemental land acquisition that enabled local government to lease and sell land near rail stops both to recapture value and ensure high ridership levels.

3.2 San Francisco Bay Area: BART Heavy Rail System

In contrast to metropolitan Toronto, growth in the San Francisco Bay Area following the 1973 initiation of regional rail services – the Bay Area Rapid Transit (BART) system – has been shaped almost exclusively by free-market forces. The absence of a regional planning counterpart to Toronto's Metro has left station-area development decisions largely in the hands of private real-estate interests and the whims of municipal zoning (Cervero and Landis, 1997).

The one impact of BART that most closely parallels Toronto's experiences has been the preservation of the CBD as the region's primary employment hub (i.e., retaining its primacy). During BART's first 20 years, some 2.6 million square meters of office floorspace and more than 60,000 new jobs were added within ½ kilometer of downtown BART stations. This growth would not have occurred were it not for BART simply because the bridges that connect to downtown San Francisco could not accommodate the additional car traffic generated by this dramatic employment gain. The use of tax increment financing (wherein all proceeds from the tax base are returned to the station areas to pay for other public improvements, such as landscaping and civic plazas) was instrumental in spurring downtown office development.

Outside of downtown San Francisco, BART has been a stronger force toward decentralization than concentration. By adding new layers of accessibility to outlying areas, BART enabled more subdivisions to be built than would have otherwise been possible due to limits on freeway capacity. Other than a handful of stations in San Francisco's East Bay where development was aggressively sought, little new clustering has occurred along BART's suburban alignments. Indeed, more suburban growth was freeway-oriented than railway-oriented. Among the suburban areas that practiced Toronto-like pro-active planning, notably the municipalities of Walnut Creek and Pleasant Hill, significant clustering occurred. For the most part, substantial subsidies were needed to jump-start development, such as underwriting of land assemblage costs and the targeting of supportive infrastructure improvements (e.g., new sidewalks and better road access to nearby freeways). In the case of Pleasant Hill, surveys of residents living near the rail station reveal that 45% of employed-residents regularly take BART to work versus only 8% of those who live in the city but beyond a ½-mile walkshed of the station (Lund et al., 2006). Research suggests this ridership bonus is largely a product of self-selection – for lifestyle reasons, people conscientiously reside near transit in order to commute by transit (Cervero, 2007). Other factors that help explain Pleasant Hill's success with transit oriented development (TOD) include a good station-area plan (that was illustrative and market-realistic) and the presence of a political champion who provided the leadership necessary to shepherd development proposals through the minefields of local public hearings and environmental reviews.

3.3 Metropolitan Washington and Arlington County

More growth has occurred near metropolitan Washington D.C.'s heavy rail system in the past quarter-century than anywhere in the United States. From 1980 to 1990, 40% of the

region's office and retail space was built within walking distance of a Metrorail station (Cervero et al., 2004). The fact that the timing of the railway investment (late 1970s through 1980s) coincided with a rapid period of growth (e.g., more jobs were added to metropolitan Washington than anywhere in the U.S.) helped steer growth to rail-served corridors. This, combined with height-limit restrictions within the District of Columbia and federal policy that mandates government offices to be located near rail stations, further encouraged TOD.

Without question, the recipient of most spillover growth from Washington D.C. has been Arlington County, Virginia, across the Potomac River from the national capital (Cervero et al., 2004). Arlington County is a textbook example of creating a vision (the "bull's eye" concept plan, shown in Figure 4) and putting in place appropriate implementation tools to achieve the vision. Through a collaborative effort that engaged local stakeholders and an ambitious campaign that targeted supportive infrastructure improvements to rail stops along the corridor, Arlington County managed to transform the Metrorail Orange line into a showcase of transit-supportive development, with mid-to-high rise towers and multiple uses today flanking the Rosslyn, Courthouse, Clarendon, Virginia Square, and Ballston Metrorail stations. Since 1970, over 15 million square feet of office space, several thousand hotel rooms, and 18,000 housing units have been added to these station areas. With the bull's eye methaphor in place to guide on-going planning, Arlington County proceeded to leverage Metrorail's presence and transform once dormant neighborhoods into vibrant clusters of office, retail, and residential development.

The transformation of once-rural Arlington County into a showcase of compact, mixed-use TOD has been the product of ambitious, laser-focused station-area planning and investment. Prior to Metrorail's arrival, Arlington County planners understood that high-performance transit provided an unprecedented opportunity to shape future growth and proceeded to introduce various strategies — targeted infrastructure improvements, incentive zoning, development proffers, permissive and as-of-right zoning — to entice private investments around stations. After preparing countywide and station-area plans on desired land-use outcomes, density and setback configurations, and circulation systems, zoning classifications were changed and developments that complied with these classifications could proceed unencumbered. The ability of complying developers to create TODs "as-of-right" was particularly important for it meant developers could line up capital, secure loans, incur upfront costs, and phase-in construction without the fear of local government "changing its mind."

The pay-off of concentrated growth along rail corridors is revealed in Arlington County's transit ridership statistics. The County today boasts one of the highest percentages of transit use in the Washington, D.C. region, with 39.3 percent of Metrorail corridor residents commuting to work by public transit. This is twice the share of County residents who live outside of Metrorail corridors. Self-selection is evident in that around two-thirds of employed-residents in several apartments and condominium projects near Rosslyn and Ballston stations take transit to work. An important outcome of promoting mixed-use development along rail corridors has been balanced jobs and housing growth which in turn has produced balanced two-way travel flows. Counts of station entries and exits in Arlington County are nearly equal

during peak hours as well as the off-peak. During the morning rush hours, many of the county's Metrorail stations are both trip origins and destinations, meaning trains and buses are full in both directions. The presence of so much retail-entertainment-hotel activities along the County's metrorail corridors has further filled trains and buses during the midday and on weekends. Balanced, mixed-use development has translated into as close to 24/7 ridership profile as any U.S. setting outside of a CBD.

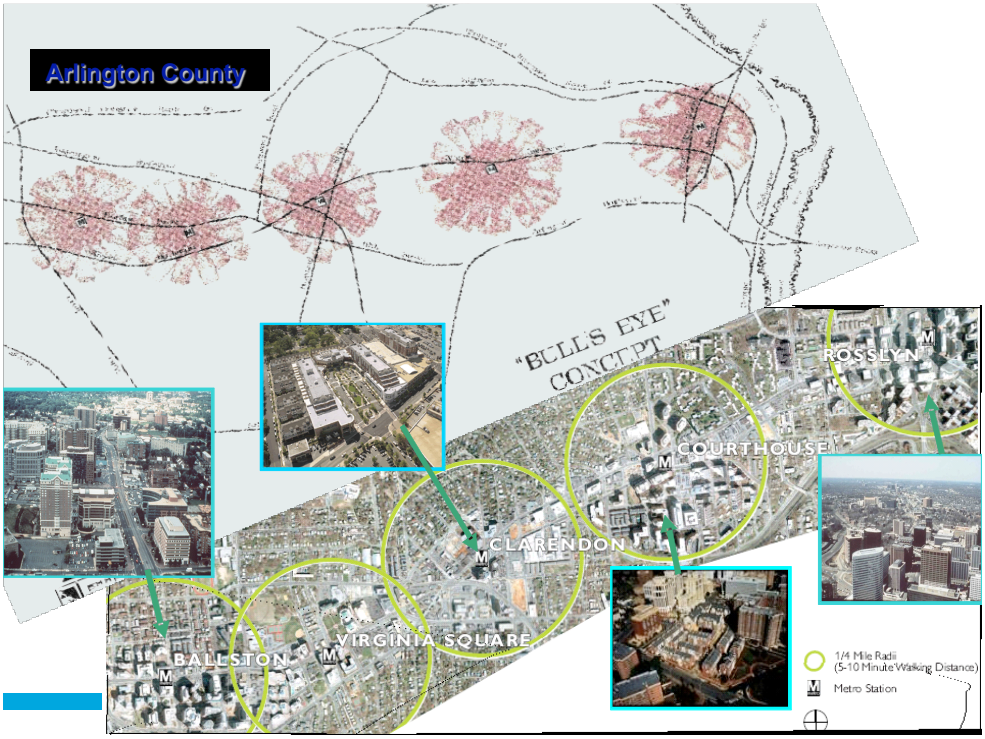

Figure 4. Arlington County's Rosslyn-Ballston Corridor: From "Bull's Eye Concept" to Implementation

3.4 Scandinavian Experiences: Metros in Copenhagen and Stockholm

The best examples of long-range planning visions shaping rail investments which in turned shaped urban growth come from two Scandinavian settings: Copenhagen, with its celebrated "Finger Plan"and Stockholm, in the form of its "Planetary Cluster Plan". In both cases, 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. 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 5.

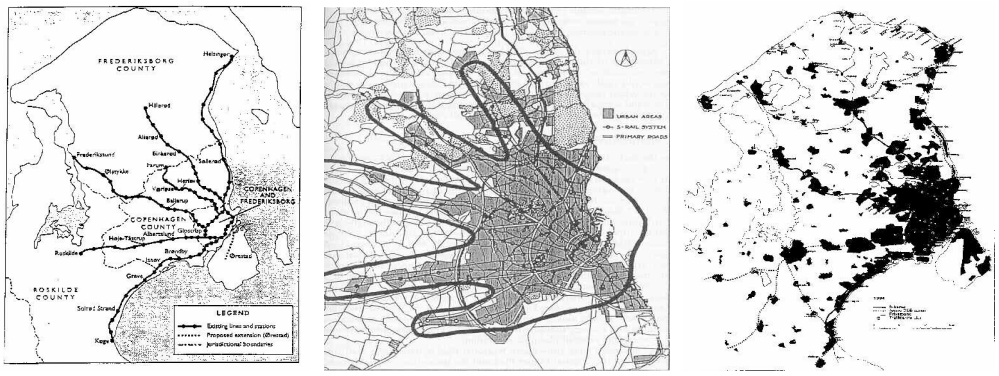

Figure 5. Copenhagen's "Transit First" Spatial Evolution: From Finger Plan, to Five-Axis Radial Investment, to Corridors of Satellite, Rail-Served New Towns

In the case of Stockholm, the last half-century of strategic regional planning has given rise to a regional settlement and commutation pattern that has substantially lowered car-dependency in middle-income suburbs. Stockholm's investment in radial rail lines has given rise to a "*string of pearls*" urban form wherein a balanced use of land for work and housing. Yet Stockholm has relatively high level of car ownership (555 cars/ 1000 inhabitants). With transit-oriented corridors, one finds more judicious and discriminate use of the private car. Most Stockholmers use public transport for the daily grind of going to work, selectively using cars for shopping and weekend excursions. Stockholm planners have consciously created jobs-housing balance along rail-served axial corridors. This in turn has produced directional-flow balances. During peak hours, 55 percent of commuters are typically traveling in one direction on trains and 45 percent are heading in the other direction. Stockholm's transit modal share is nearly twice that found in bigger rail-served European cities like Berlin and even higher than inner London's market share. Perhaps most 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).

While the first-generation of TOD in metropolitan Stockholm was on former greenfields (e.g., Vallingby and Kista), in recent times a push has been made to promote "Green TODs" on former brownfields. The most notable example of this is Hammerby Sjöstad, an eco-community that has taken form along a recently built inner-ring tramway. Hammerby Sjöstad is a marriage of TOD and green urbanism/green architecture. The combination of railway services, car-sharing, and bike-sharing has dramatically reduced VKT/residents and correspondingly greenhouse gas emissions and energy consumption. And the design of an energy self-sufficient and low-waste community has shrunk the project's environmental footprint. Today, residents of Hammerby Sjöstad produce 50% of the power they need by turning recycled wastewater and domestic waste into heating, cooling, and electricity.

4. Experiences with Other Railway Investments

What affects have railway investments other than heavy rail/metro systems – notably light-rail transit (LRT), tramways, commuter railways, and high-speed rail (HSR) – had on land development? Less systematic research has been conducted on the land-use impacts of these investments, although useful policy insights can still be gained from experiences recorded to date.

4.1 Light-Rail Transit

In the case of LRT, there has generally been less high-rise, clustered development around stations than has been the case with metros mainly because the slower operating speeds (due to factors like mixed-traffic operations, at-grade intersection crossings) which have meant less time-competitiveness with the private car and fewer regional accessibility benefits (Cervero and Seskin, 1995). The fact that many LRT systems have served a limited set of corridors vis-à-vis the more regional scope of many metro services have further suppressed development impacts. Another limiting factor has been the conscientious decision to site investments in low-cost corridors – e.g., freeway medians, dis-used or abandoned freight rights-of-way (Cervero, 1984). The focus on cost-minimization has in turned minimized LRT's development impacts. There are exceptions, however, such as Mockingbird Station at the suburban Dallas Area Rapid Transit (DART) light-rail station. Located four miles north of downtown Dallas, Mockingbird Station is a mixed-use, urban "chic" village linked directly to a light rail station (after which it is named) via a welcoming pedestrian bridge. The assemblage of offices, shops, restaurants, and lofts near the station cost around $145 million to build, a substantial sum given that such a "product" had absolutely no track-record in car-friendly Texas. In 2003, residential rents at the Mockingbird station were going for $1.60 per square foot per month; other comparable nearby properties not served by transit were getting $1.30, or 20% less.

One of the best examples of LRT triggering a downtown building boom is Jersey City, New Jersey (Cervero et al., 2004). The 15-mile Hudson-Bergen light rail system has served to channel growth along Jersey City's burgeoning waterfront, interlacing several dozen recently built mid- and high-rise office, retail, and hotel towers. Within the 2.5 square-kilometer downtown Jersey City development district, the 22 parcels adjacent to the light-rail tracks comprise the majority of the 11.8 million square feet of commercial space built downtown during the 1998-2004 period and over 40 percent of housing-unit additions (Figure 6). And within two city blocks (or 750 feet) of the LRT tracks, all of Jersey City's office and hotel additions and over three-quarters of housing units have congregated. Much of this growth is attributable to office activities spilling over from Manhattan across the Hudson River (including the 12 million square feet of office development displaced at the lower tip of Manhattan by the 9/11 tragedy). The Hudson-Bergen line served as a powerful magnet, focusing the growth that migrated from Manhattan to the rail-served corridor.

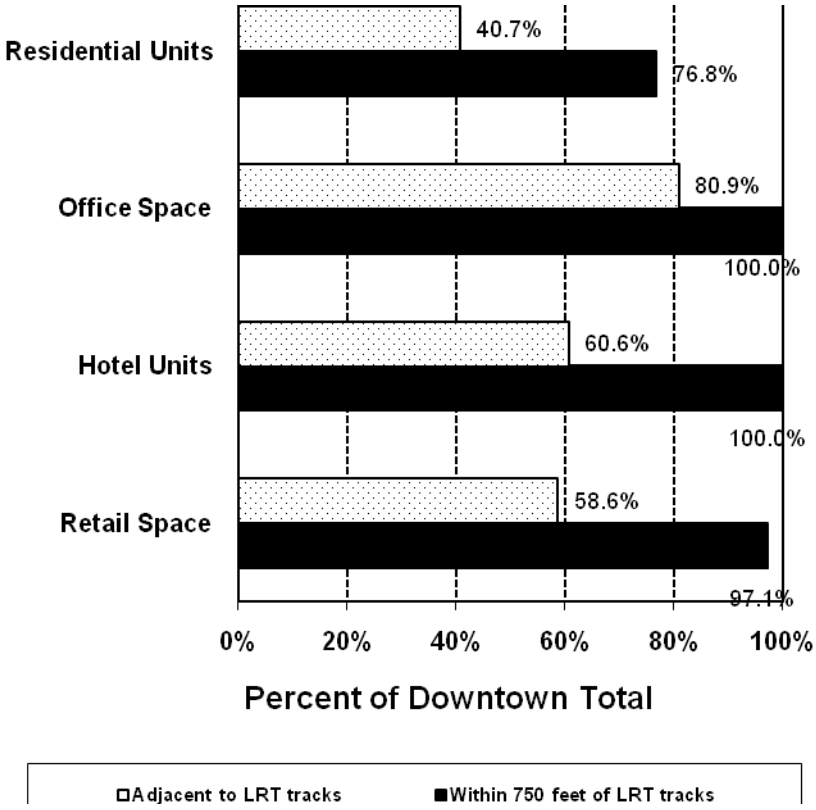

Figure 6. Share of Development Activity Near Light Rail Line in 2.5 Square-Kilometer Downtown Jersey City, 1998-2004

4.2 Commuter and High-Speed Rail

Commuter passenger rail systems that funnel professional-class workers to CBDs of large metropolitan areas have mimicked the land-use impacts of metro systems: as radial systems, they have strengthened downtowns, allowing more jobs and retail activities to concentrate in urban cores than would otherwise be possible (Cervero, 1998). However they have also spurred decentralization, enabling more fringe-area subdivisions to be built than would otherwise be possible. Studies show that the construction of the GO Transit commuter rail system in metropolitan Toronto accelerated suburbanization and exurbanization, prompting one observer to equate the region's settlement pattern as "Vienna surrounded by Phoenix" (Pill, 1990).

High-Speed Rail (HSR) are in a position to have stronger growth-inducing influences than metro rail systems because they add substantially higher increments of accessibility, particularly along rural corridors. But because HSR largely competes with inter-city air travel,

the kinds of land uses that could be expected to congregate around HSR stops differs from metropolitan rail systems. Since relatively few people regularly commute by HSR, less residential clustering is expected at HSR stations. At terminuses, offices and commercial uses might be expected and at other stations there is the potential for discretionary destinations that attract people periodically, like convention-hotels, large retail centers, and entertainment complexes.

The best insights about the city-shaping impacts of HSR come from Japan's Shinkansen HSR system. The Tokaido Line that opened from Tokyo to Osaka in 1964 had a stronger impact on employment than residential growth, with much of the office and commercial construction concentrating at the terminal stations of these two primary cities (Sawada, 1995). Restaurant and hotel businesses have also prospered along Shinkkansen corridors, reflecting social-recreational travel to cities with Shinkansen stations (Nakamura and Ueda, 1989). Sands (1992) contends that the Shinkansen's growth-related impacts are partly attributable to the conscious decision to route HSR in areas experiencing or expected to experience growth, making outcomes a self-fulfilling prophesy. There is some evidence that the Shinkansen system enlarged Tokyo's commuteshed, made possible by the trend toward part-time, contingent labor (wherein workers only go to the head office a few days per week) (Sanuki, 1994).

Outside the primary cities of Tokyo and Osaka, urban growth occurred mostly where substantial investment was made in secondary feeder rail lines that connect to the HSR station. This has been the case at the Shin-Yokohama station, which has witnessed the fastest ridership growth of any Shinkansen station to date. Investment in a subway connection to the Shin-Yokohama station plus ancillary infrastructure improvements (e.g., sanitation) spurred significant land-use shifts to corridors that feed into the HSR station (Amano et al., 1995). Some observers have referred to the concentration of new land development along secondary feeder and distributor networks as "Extended TOD", effectively extending the sptial reach of HSR and metro investments by overcoming what has been called "the last-mile problem" (i.e., the difficulty of reaching destinations beyond a mile of many non-urban rail stations (Warren, 1997).

5. Policy Lessons Summary on Rail Transit and Urban Development

Global experiences with rail investments impart important lessons about their likely impacts on urban form. While most research and recorded experiences are drawn from North America, Europe, and elsewhere in the developed world, the lessons are thought to be generic and certainly applicable to railway systems in Latin America. These lessons largely draw from the literature reviews and case summaries of Knight and Trygg (1977), Kelley (1994), Huang (1996), Cervero (1984, 1998), and Cervero and Seskin (1996).

- *Urban railways redistribute growth more than it creates growth.* Railways influence the distribution more than the amount of development within a region. It channels where

already committed growth occurs, often shifting it from one radial corridor (i.e., higway-oriented one) to another radial corridor (i.e., a rail-served one). In big, congested urban settings, this redistribution can translate into net economic and employment growth, mainly in the form of agglomerations (i.e., taller buildings) and the associated economic benefits made possible by railway investments.

- *A prerequisite to significant land-use changes is a healthy regional economy*. If railways are to have much impact, there needs to be growth to channel. Regardless how much pro-active planning occurs or public-sector money is spent, railways will exert negligible land-use impacts in areas with weak regional economies. The meager land-use changes following the introduction of light-rail services in U.S. Rust Belt cities like Pittsburgh and Buffalo are cases in point.

- *Land-use impacts are greatest when railway investments occur just prior to an upswing in regional growth.* Experiences show that the timing of railway investments matter a lot in terms of whether significant land-use shifts occur. Noted urban sociologist Homer Hoyt observed some 70 years ago that urban form is largely a product of the dominant transportation technology in place during a city's prevailing period of growth (Cervero, 1998). Toronto's subway investment in the late 1950s during a period of rapid immigration to the city was fortuitous since many new housing projects were built within walking distance of rail stations. For other cities, like Los Angeles which invested heavily in subway, LRT, commuter rail lines in the 1990s, much of the region's urban growth had already taken place, there were relatively small increments for new growth for railways to steer – the proverbial "too little, too late". For many rapidly developing cities, including those in Latin America, investing in railways during growth spurts can translate into appreciable land-use impacts.

- *Radial rail systems can strengthen downtown cores*. Experiences from Toronto, San Francisco, Tokyo, and elsewhere show that radial rail systems lead to increased employment growth in urban centers since these are the places that receive the largest incremental gains in regional accessibility (Figure 7). While regional shares of jobs and retailing that are downtown often still fall in the wake of new rail investments, they would have fallen even more were it not for CBD-focused railway services.

- *Railway systems generally reinforce and often accelerate decentralization trends*. By improving accessibility to different parts of a region, extensive railway networks, like their highway counterparts, generally encourage suburbanization, to some degree (Figure 7). While growth might be funneled in a particular direction as a result of new transit services, more often than not this direction will be outward.

- *Pro-active planning is necessary if decentralized growth is to take the form of subcenters*. Whether decentralized growth takes a multi-centered form (i.e., TOD) rests largely with the degree of public commitment to strategic station-area planning, carried out on a regional scale (Figure 7). Experiences in cities like Toronto show that an

aggressive stand to leverage the benefits of rail services can lead to more concentrated forms of decentralized growth. Given public-resource commitments, railways can not only strengthen the core, but also induce selected sub-centering. While railways contriute to outward growth, they can help to more efficiently organize whatever development occurs within traditional built-up areas.

- *Railways can spur central-city redevelopment under the right conditions*. When government agencies are willing to absorb some of the risks inherent in redeveloping depressed and economically stagnant neighborhoods, railways can help attract private capital and breathe new life into struggling areas. There must be an unwavering public commitment to underwrite redevelopment costs and provide needed financial investments. The *quid pro quo* is that sharing in upstream risks can mean the public sector eventually shares in the downstream rewards of urban renewal. Experiences suggest that even with such investments, it is an uphill struggle to turn around several distressed urban districts, regardless of a railway's presence. In such settings, the issue is less one of transportation access and often more one of crime, inter-generational poverty, and private dis-investment.

- *Other pro-development measures must accompany railway investments*. In addition to financial incentives, other "software" policies are needed to make railway "hardware" attractive to land developers. Foremost among these are: permissive and incentive zoning, such as density bonuses; the availability of nearby vacant or easy-to-assemble and developable parcels; support for land-use changes among local residents (i.e., the absence of organized opposition and not-in-my-backyard, or NIMBY, forces); a hospitable physical setting (in terms of aesthetics, ease of pedestrian circulation, and a healthy neighborhood image); complementary public improvements (such as upgrading of sidewalks, expansion of water and sanitation trunk-line capacities, and burying utilities); and an absence of physical constraints (e.g., preemption of land development by park-and-ride lots or the siting of a station in a busy freeway median).

- *Transit service incentives and automobile disincentives ("equalizers") help in inducing station-area land-use changes*. Provision of frequent and reliable rail and feeder bus connections is of course needed if private capital is to be enticed to station areas since only then will railways become time-competitive with the private car. Such pro-transit measures often need to be accompanied by "equalizer" policies that remove many of the built-in incentives to drive, such as the availability of plentiful, low-cost parking. Congestion pricing in Singapore, Stockholm, and London partly explain why railway services in these cities are so heavily patronized and not un-relatedly, why new land development is occurring around these cities' rail stations.

- *Network effects matter*. For fixed-guideway railway systems to induce large-scale land-use changes, it is essential that they mimic the geographic coverage and regional accessibility of their chief competitors, limited-access freeways and highways. The strong city-shaping influences of metros in Paris, London, and Tokyo owe in large part to

such network effects wherein railways serve comparable shares of origin-destination combinations as freeway and motorway networks. The addition of a new exclusive-guideway line creates spillovers and synergies, benefiting not only the newly served corridors but existing ones as well. For existing metro lines, newly opened lines increase the number of regional origin-destination combinations that can be served. The absence of major land-use impacts following the opening of LRT services in the U.S. are partly due to the absence of such network effects – single-line LRT services, such as the Hiawatha service in Minneapolis, serve a fraction of regional origin-destination combinations that are served by the city's fully developed freeway network.

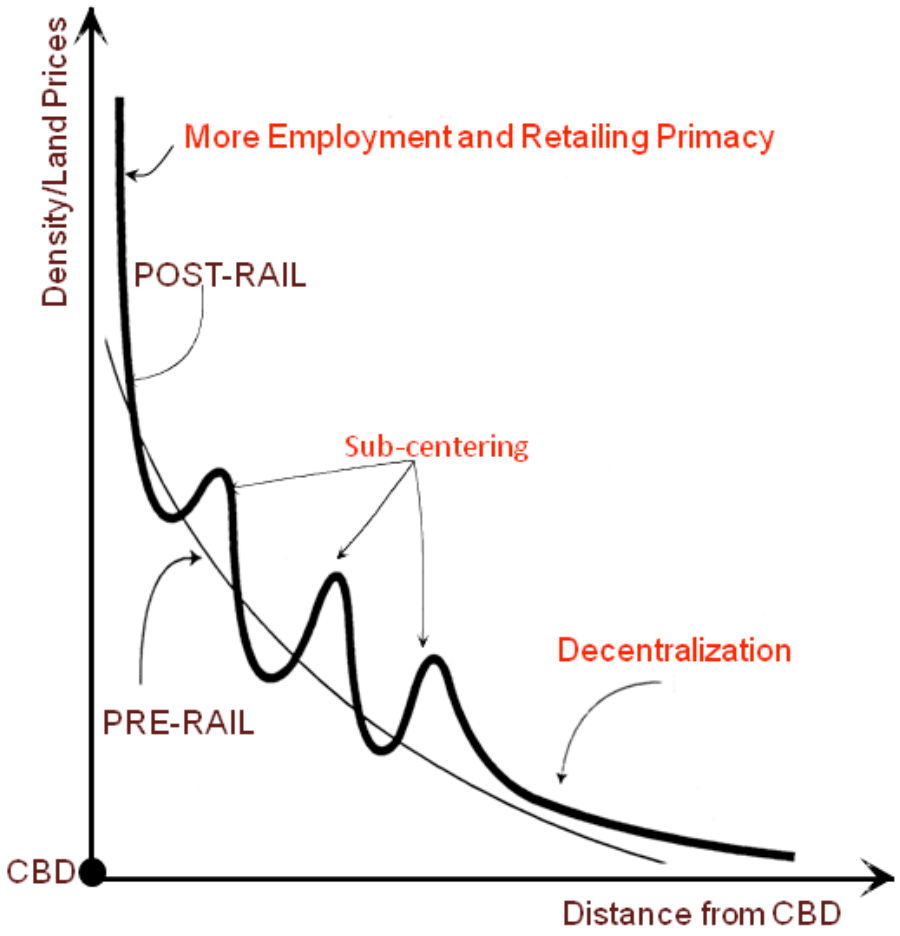

Figure 7. Likely Land-Use Outcomes When Urban Rail Investments are Pro-actively Leveraged

6. Railways and Urbanization in Latin America

Less is known about the city-shaping impacts of railways in the developing world in general and Latin America specifically, in large part because there have been few systematic studies on land-use impacts to date. Still, experiences show that metros in Santiago, Chile, Caracas, Mexico City, and São Paulo, Brazil, like their North American and European counterparts, have largely encouraged regional decentralization (Institution of Civil Engineers, 1990). Unlike in the developed world, however, there appears to be less agglomeration impacts in core areas following the opening of metro systems, although without railway investments, the primacy role of core areas would have been weakened more by roadway construction and rapid motorization.

In the case of Santiago, Figuero (1990) found that the metro relocated poor to the metropolitan periphery while modernizing the inner city. This pattern of settlement, with the affluent located nearest the city center the least affluent at the periphery, typifies most Latin American cities. Similarly, by focusing on the central core and serving closer in neighborhoods, Caracas's metro has catered more to affluent population groups and less to the poor (Sperling, 1981). Caracas metro's biggest development impact has been to spawn urban renewal in the city's main valley (Tobia, 1989). Upzoning around core stations by local planning officials helped spur densification. From 1983 to 1989, more than 70% of all non-residential buildings constructed were within the "area of influence" of Caracas Metro's line 1. Additionally, two pedestrian malls were built over the underground section of line 1 and a retail plaza was built under the elevated section of line 2. Plazas and open spaces have also be designed around various metro stations, incorporating the works of selected Venezuelan artists.

In Latin America and elsewhere in the developing world, metro investments have likely contributed to social stratification and informalization of housing (Cervero, 2001). For this reason metros have been criticized for failing to alleviate poverty and specifically for being regressive, using scarce government financial resources for purposes that benefit the rich far more than the poor. Metros likely allow formal land development to displace the poor to informal settlements on the periphery (e.g., barrios and favelas). Research shows that those workers living in informal housing on the fringes spend as much as one-quarter of daily earnings on transportation, often in the form of paying multiple informal transit operators for access to the central city (Cervero and Golub, 2007). A welfare analysis of informal vans and suburban railways serving the low-income neighborhood of Baixada Fluminense in Rio de Janeiro found that giving priority to "formal" bus and railway services would yield net benefits to the poor and rich alike (Golub, 2003). The influences of informal-sector activities are felt not only in the fringes of large, rail-served Latin American cities, however. The absence of office and high-end commercial development near central metro stations in Mexico City has been associated with the nuisance effects of informal vendors, street peddlers, and various forms of illicit commercial activities (Cervero, 2001). The land-development impacts, and not unrelatedly, the income redistribution effects of metro investments, has gained increased policy attention in recent years. Most international aid organizations and development banks today consider contributions to poverty alleviation as one of many factors that weigh in the decision to provide

loans for capital-intensive railway investments.

7. Land Value Impacts and Value Capture Opportunities

The degree to which rail transit investments yield benefits is perhaps best gauged by the impacts on real-estate sales prices surrounding rail stations. The accessibility benefits conferred by public infrastructure investments in railways get capitalized into higher values for land parcels immediately surrounding stations. It is important to note, however, that unless a rail investment causes a net inflow of private capital and investment into a region (that otherwise would not have occurred without the rail investment), then the land-value impacts are largely pecuniary and redistributive. (Some benefits might accrue from the agglomeration economies of rail-permitted high-rise development, although these are generally small relative to net generative impacts; see Cambridge Systematics, et al., 1998). However, to the degree that a rail investment significantly reduces traffic congestion and confers travel-time savings to workers and businesses, near rail systems yield real economic benefits in the form of increased economic productivity. This is thought to represent the situation of many rapidly industrializing economies of the world, including those in Latin America.

A significant body of research documents the land-value capitalization benefits of railway investments across the world (Huang, 1996; Cambridge Systematics, et al., 1998; Dunphy et al., 2004). Significant gains land prices occur in large part because there is a finite, limited number of benefitting properties as a result of a railway improvement. For premiums to accrue, it seems important that transit be in a neighborhood with a reasonably healthy real-estate market and free from signs of stagnation or distress (Dunphy et al., 2004). Experiences show that the greatest increases in land prices often occur before the opening of railway services as land speculators anticipate future price appreciation (Damm et al., 1980) and that capitalization effects are greatest in highly congested, less car-dominant settings (Cervero, 1998). Land-price premiums also tend to increase during periods of economic expansion, for more mature and extensive railway networks (that thereby result in railways providing comparable accessibility benefits to auto-highway networks), and where pro-active government policies and incentives help leverage development (Cervero and Duncan, 2002).

Under the right conditions, local governments stand to capture some of the value-added produced by public investment in rail transit, either indirectly through increased property tax proceeds or directly through programs like benefit assessment, betterment taxes, or negotiated joint development initiatives (such as equity partnerships between developers and local governments). The concept of value capture as a means to fund or recover the cost of public infrastructure gained interest when the second-generation of urban railway investments in the U.S. – e.g., San Francisco BART and Washington Metrorail – were built, particularly following the 1978 publication of *Windfalls for Wipeouts: Land Value Capture and Compensation* by Hagman and Misczynksi (Fogarty et al., 2008). Through examining the impacts of public investments on land values, Hagman and Miscyznski (1978) argued that windfalls to property owners produced by public infrastructure investments should be captured by cities (or other

public agencies) through taxes and fees tied to land values.

To the degree fair and equitable programs can be mounted, governments have a lot to gain in sharing in some of the profits introduced by new transit facilities. In particular, revenues gained through value capture can go toward leveraging TOD. Municipalities must often take the lead in attracting private capital to rail station areas by "sprucing up" the neighborhood through improved landscaping and urban design, by introducing complementary infrastructure improvements (like sidewalks and the under-grounding of utilities), and in the case of riskier settings, underwriting private-sector land acquisitions costs. All of this takes money, often lots of it. Thus, value capture stands as a potential source of revenue not only to help pay off the debt on transit investments but also to pay for upfront and ancillary neighborhood improvements that can help leverage TOD.

Value capture also has equity appeal. Why, the reasoning goes, let a handful of fortunate landowners, or worse yet, real estate speculators, reap the windfalls created by public investments in transit? Returning the value-added to retire construction bonds capture can relieve cash-strapped local governments of fiscal burdens while also reducing land speculation and creating a more compact, transit-oriented urban form. Having the transit entity control the land around stations, moreover, increases the chance that major trip generators and transit-oriented land uses – such as retail plazas, offices, and civic uses – occupy strategically important land parcels, thereby increasing ridership and farebox returns.

A third benefit of value-capture schemes is they can moderate land speculation around rail transit stations. With unregulated land markets and high demand for private development in highly accessible locations, land speculators are likely to bid up the price of real estate in anticipation of future windfalls. Frequent turnover of land ownership between the time a rail investment is announced and services actually begin operating can lead to an over-heated local real estate market. This can not only result in artificially inflated land prices that eventually decline but also can cause considerable displacements, particularly of lower-income households and small businesses. To the degree that the public sector co-participates in the land-value increases that are produced by public investments in railways, the motivation to purchase land purely for speculative purposes of reaping windfall profits is tempered.

Value capture is not without limitations, as outlined by Peterson (2008). One, urban land markets are notoriously volatile and recent gains in property values could reflect a land-asset bubble. Thus recapturing overheated property values could mean future declines in revenues following a sharp economic downturn. Two, land sales often lack transparency and accountability, sometimes conducted off-budget through private negotiations and sometimes a victim of graft and corruption. Incomplete land registries and titling records can also complicate implementation (Cervero and Susantono, 1999). Lastly, governments can artificially inflate land prices through restrictive zoning as a revenue-producing ploy but in so doing distort local real-estate markets.

7.1 Value Capture Mechanisms

Land value increases induced by railway investments and operations yield income that accrue to the public sector usually in the form of higher property tax proceeds. This indirect form of value capture, however, cannot be counted upon by railway companies and public transit operators since property tax proceeds usually go to municipal coffers and thus are not dedicated for the purposes of paying off capital debt incurred in building railways. Indirect property tax gains are thus an imperfect and undependable form of rail-transit value capture.

More dependable are value capture strategies that target revenue gains to specific districts or projects. These generally fall into four categories (Fogarty et al., 2008; Cervero et al., 1991):

- *Special Assessments and Betterment Taxes*: A tax assessed against parcels that have been identified as receiving direct benefits from railway investments;

- *Tax Increment Financing:* A mechanism that allows the public sector to set aside the growth in property tax (or sometimes sales tax) income resulting from railway investments and dedicate the incremental increase in incomes to help pay for the capital investment and ancillary activities (e.g., streetscape enhancements);

- *Impact Fees:* A fee assessed on new development or redevelopment within a defined district as a means to defray the cost of expanding and extending transit services to the affected properties;

- *Joint Development*: A public-private partnership (PPP) to deliver transit-oriented development (TOD), usually involving development on transit agency owned land or airspace and involving either revenue-sharing or cost-sharing.

Special Assessments and *Betterment Taxes* are more often used to fund sewer, water, and sidewalk improvements than railway systems. In the U.S., benefit assessment districts were formed to co-finance ancillary improvements (e.g., undergrounding utilities, road expansion, streetscape and sidewalk enhancements) for the 8-km Red Line subway in Los Angeles as well as bus-malls in Minneapolis, Denver, and Portland, Oregon (Cervero et al., 2004). In Los Angeles, assessments levied on commercial properties in built-up rail-served corridors have generated some $180 million to date. Additionally, around 20% of the capital costs of building Portland, Oregon's downtown streetcar was paid by special assessments (Fogarty et al., 2008). Betterment taxes have long been used in Bogotá, Colombia, generating more than $1 billion to finance street and bridge improvements over the 1997-2007 period and are today under consideration for financing Bogotá's planned underground metro. Rather than estimate parcel-by-parcel gains in land-value due to individual investment project, Bogotá finances a citywide bundle of public works projects that are broadly differentiated by benefit

zone and other factors. The city's celebrated TransMilenio BRT system, research shows, have produced land-value premiums (Rodriquez and Targa, 2004; Rodriquez and Mojica, 2008) thus backers of the metrorail system contend that betterment taxes of properties in districts directly served by rail stations will be a fair and efficient means to generate funds. Betterment taxes are also one of several funding options being considered for financing the expansion of Buenos Aires's subway network. Assuming a good land registry and property-tax administrative system is in place, assessment financing and betterment taxes has considerable potential for helping to defray the capital costs of railway investments in the developing world, including Latin America.

Tax Increment Financing differs from assessment financing in that it funnels incremental increases in property-tax revenues back into a district to help revitalize distressed neighborhoods. Tax increment financing (TIF) has been used extensively to encourage TOD in many parts of the United States, including the city of Chicago where half of the 129 TIF districts contain railway stations. The state of Pennsylvania applies TIF in Transit Revitalization Investment Districts (TRIDs) to promote economic development and TOD. A criticism of TIF is it diverts tax dollars that would otherwise accrue to a city's general treasury and as thus creates a privileged (i.e., subsidized) zone. Such equity concerns have limited the application of TIFs to much of the developing world.

Impact Fees are a charge assessed on new development as a means to defray the cost of expanding and extended public services. Whereas special assessment and betterment financing is applied to all properties within an effected district, impact fees are normally passed on only to newcomers. In 1981, the city of San Francisco, California introduced a Transit Impact Development Fee (TIDF) levied against new downtown office buildings to produce income for operating and maintaining the city's MUNI transit network, comprising light-rail, diesel bus, trolley bus, and cable-car services. TIDF revenues produce around $10 million annually, used only for operations vis-à-vis capital expansion. Broward County, Florida has a Transit Oriented Concurrency system that similarly generates income for transit operations by levying a fixed fee on new development. This program covers around 30% of annual bus-transit operating and capital costs for the county (Fogarty et al., 2008). Because limiting impact fees to new development only can deter investments in all but the healthiest real-estate markets and can inflate the cost of housing, it has been applied on a limited basis outside of the United States. In the developing world, exactions are more common wherein developers cover the cost of expanding infrastructure (e.g., water and sewer trunkline capacities) to serve a specific master-planned site. Private contributions tied to land-based assessments have recently been used to build and expand connecting roads and bridges to master-planned developments in Cairo, Egypt, Mumbai and Bangalore, India, Cape Town, South Africa, and Istanbul, Turkey (Peterson, 2008).

Joint development is arguably the form of value capture most applicable to rail transit. Under this approach, a public transit agency partners with a private developer to build a real-estate project on land or air rights owned by the transit agency itself. In return, the transit agency receives either revenue (i.e., revenue sharing) or passes on part or all of the costs of rail-station and ancillary construction (i.e., cost sharing). Unlike other forms of value capture,

however, joint development is a voluntary arrangement between public and private interests seeking "win-win" outcomes (Cervero et al., 1991). Among the most common forms of revenue-sharing schemes are land leases, air-rights development, and station interface or connection-fee programs. Cost-sharing schemes include sharing construction expenses, incentive-based programs that produce benefits for private financing (e.g., density bonuses), and joint use of equipment like ventilation systems. As a value capture tool for transit, joint development has the most appeal in settings where a significant amount of land is available to a transit agency, preferably purchased on the open market at a fairly low cost (which usually means prior to formal announcement of a new railway project). To the degree joint development is limited to a geographically restricted area, such as one or two small parcels owned by a transit agency, it fails to capture value from a broader area benefiting from new transit services.

7.2 Transit Joint Development as Value Capture

Because joint development is controlled by a transit agency, it is the form of value that has the greatest potential to financing rail investments in much of the world. It requires, however, an institutional capacity to expand beyond the traditional mission of transit agencies – i.e., building and operating transit services – and to venture into other entrepreneurial realms, like value capture. Thus institutional reforms are often a necessary part of any successful transit value capture scheme.

The importance of being entrepreneurial is underscored by experiences in Washington, D.C. Over the past two decades, the Washington Metropolitan Transportation Authority (WMATA) – which designed, built, and today operates the region's rail transit and public bus services – has aggressively sought to recapture value through joint development activities. Washington Metrorail's joint development program of air-rights leases and station connection fees generate around 2% of the system's annual revenues however research shows the increased ridership and thus farebox intake at least doubles this percentage (Cervero et al., 2004).

Pro-activism accounts for much of WMATA's joint development success. WMATA is an independent regional transportation authority that oversees rail and bus operations in a fairly complex institutional setting: the District of Columbia and two states, Virginia and Maryland, a region with over 6 million inhabitants. A vital step in WMATA pursuing value capture was the creation of a real-estate development department within the agency at the very beginning, prior to the construction and opening of railway services. By hiring seasoned real-estate professionals to staff and manage this department, WMATA was well positioned to seek out remunerative joint development possibilities. Private-sector experiences helped to create a more entrepreneurial approach to land development than is found in most transit agencies. Importantly staff members were given the financial resources to purchased land around planned rail stations on the open market, often before formal plans were announced and thus at fairly reasonable prices. Rather than waiting and reacting to developer proposals, WMATA's real-estate office actively sought out mutually advantageous joint-development opportunities.

With financial and institutional support provided by board members, WMATA's real-estate office has over time amassed an impressive portfolio of land holdings, much of it purchased on the open marketplace and some comprising former farmsteads that were purchased a favorable prices. To date, WMATA had undertaken more than thirty development projects at a value of more than $2 billion on land the agency owns.

Over time, WMATA has refined its joint development activities. Today, candidate station-area sites are carefully screened according to a set of criteria that gauge development potential. For sites selected, a Request for Proposals (RfP) is issued to solicit developer interests. Through negotiations, a developer team is chosen and contracts are entered into specify the financial terms of the deal. With the help of a private real-estate firm, WMATA now rates potential sites according to the likely degree of private-sector interests and development constraints. WMATA-owned land and air rights get released to the development market not unlike if it were in the hands of a private-sector consortium.

7.3 Guidance on Value Capture and Joint Development in the Developing World

Joint development initiatives where public and private interests voluntarily enter into agreements are likely the best form of transit value capture in rapidly growing cities of the developing world. Presumably, both parties who willingly enter into deals perceive benefits from co-developing near transit stations, thus transit's value-added in these instances is indisputable.

Success stories and model demonstrations are effective tools for advancing and proliferating transit joint development. International aid agencies and lending institutions can seed such activities by tying loans and aid for new railway investments to joint development requirements, providing test-beds for other transit operators to emulate.

Step one in prompting a city or railway agency to aggressively pursue transit joint development is institutional reforms. Notably, as was the case with WMATA in Washington, D.C., a railway entity eligible for external loans and funding support should be required to create a real-estate development division within the organization. This is most likely to occur where a single transit authority exists, as was the case with WMATA. The real-estate development department should be staffed with individuals with private-sector experience to create a more entrepreneurial approach to land development. Creating a town-planning and urban design department to ensure joint development projects are of a high quality and pedestrian-friendly, and are architecturally integrated, can be another key institutional reform, as discussed later with the case of Hong Kong.

With a real-estate development team in place, financial resources then need to be provided for the agency to purchase and amass land parcels around planned rail stops. Ideally this is done early in the process when land values are fairly low, such as at the terminuses of planned lines that extend to existing agricultural land. Once a portfolio of real estate exists, a reputable real-estate consulting firm should be hired to scan and assess the development

potential of agency-owned land, using cost pro formas and other tried-and-true assessment tools. After parcels and air rights are ranked and assessed according to their development potential, the transit agency should then issue RfPs to solicit private developer interest. It is important that other stakeholders – notably planners and decision-makers of the affected municipal jurisdiction – are involved in the process to ensure supportive zoning and land-use regulations are in place and that any joint development scheme contributes to larger community goals, such as creating pedestrian-friendly TODs.

Once development partners and joint development schemes are selected for high-priority sites, the transit agency needs to monitor project construction and development outcomes to ensure compliance with the terms of a developer agreement. Over time, adjustments need to be made to ensure joint development schemes apportion revenues and expenses fairly among partners and allow for steady, dependable revenue streams. It might also be possible to one-day replace RFPs for individual sites with a master development agreement wherein a development team has access to multiple development sites along a railway corridor. This provides greater flexibility in phasing in TODs according to shifts in business cycles and real-estate market conditions. Several U.S. cities, notably Dallas, Texas, Raleigh, North Carolina, and Denver, Colorado, are currently exploring such master development agreement options as part of planned rail-transit extensions.

While experiences with transit joint development are largely limited to the developed world, the series of steps and guidelines outlined above are applicable in any setting, including Latin America. The principles of value capture and joint development are pure and widely embraced by land economists based on a solid theoretical foundation. Acting on these principles requires both a political will and institutional capacity. International aid agencies and lending institutions are likely the best agents to prod local governments to put in place rail transit agencies that can carry out the practices of WMATA and other entrepreneurial entities.

8. Value Capture: Experiences in Tokyo and Hong Kong

The most notable contemporary examples of private railway construction of the majority of urban rail lines, not just extensions (as has been the case in Latin America), come from two of east Asia's economic juggernauts: Hong Kong and Tokyo. In contrast to the experiences of WMATA and other agencies in recapturing value through joint development, special assessments, and other schemes, in both of these cities the railway agency practiced land development itself. What distinguishes both cases is private railway companies' reliance on property development to directly generate profits (vis-à-vis indirectly recapturing value through deals with private land developers). In Hong Kong, a private corporation has assumed the role of building the city's modern urban rail systems, relying mainly on returns from ancillary land development to cover construction and development costs. Metropolitan Tokyo has an even longer history of private railway construction. Over the past half century, private railway corporations have constructed new towns around railway stations throughout the suburbs of Tokyo, exploiting the land-value gains in and around railway stations conferred by

improved accessibility.

8.1 Tokyo's Private Railways

Tokyo's railway network – owned and operated by a mix of public, private and quasi-private entities – is, by far, the world's largest. Most of the region's extensive network of suburban railway lines was built by private companies who received government concessions and exclusive rights to design, build, and operate rail services. Tokyo's railway companies have historically leveraged real-estate development to both pay for infrastructure and produce profits for share-holders. And they have similarly opened convenience stores and shopping malls within and adjacent to stations.

What most distinguishes Tokyo's railway companies, however, is their construction of not just a handful of buildings but also veritable new towns on once virgin lands (Cervero, 1998). West of central Tokyo, where many of the region's most up-market suburbs are located, entire communities are today the domains of powerful conglomerates that are best known for their department store chains – Tokyu, Odakyu, Keio, and Seibu – but which first and foremost are in the business of railway and real-estate development. All started as private railway companies and over time branched into businesses closely related to the railway industry, including real estate, retailing, bus operations, and electric power generation. Such business expansion made perfectly good economic sense. Placing shopping malls, apartments, and entertainment complexes near stations generated rail traffic; in turn, railways brought customers to these establishments. During the 1980s at the height of railway/new-town co-development and a surge in Japanese real-estate prices, railway companies were earning investment returns on ancillary real-estate projects in the range of 50% to 70%, with profit margins from real estate far outstripping those from transit services (Figure 8).

The 1990s and onwards have marked a new era for Tokyo's private railway companies. For one, the burst of Japan's real-estate price bubble saw the market valuations of rail companies' land-holdings fall. Additionally, powerful demographic trends like declining birth rates and an aging population, combined with a slowing of the economy, reduced the demand for new-town construction. To spread the risks of a shakier real-estate market, private railway companies have in recent years partnered with third parties to pursue large-scale development projects. The redevelopment and infilling of strategic central-city land parcels is also being pursued by Tokyo's two former public railways, JR East and Tokyo Metro. JR East's showcase real-estate project is Tokyo Station City, jointly developed by the railway company and private interests. Tokyo Station City features high-rise, class-A office buildings, retail centers, and hotels. 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.

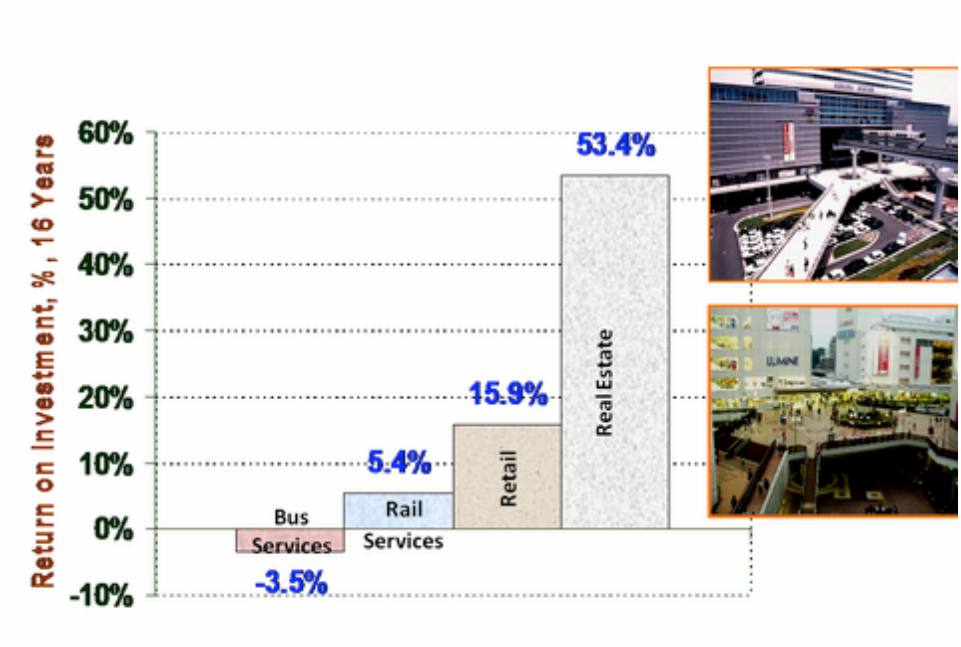

Figure 8. Rates of Return by Private Railway Corporations in Metropolitan Tokyo, 1980-1996.
Source: Cervero (1998)

8.2 Hong Kong: Value Capture and Place-Making

Hong Kong is one of the few places in the world where public transport makes a profit, courtesy of the city's rail operator – MTRC – pursuing what is called the "Rail+Property" program, or R+P for short (Cervero and Murakami, 2008). R+P is one of the best examples anywhere of transit value capture in action. 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. MTRC has used its ability to purchase the development rights for land around stations to recoup the cost of investing in rail transit and turn a profit. 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 a railway station (Tang et al., 2004).

Profit motive accounts for MTRC's active involvement in land development. As a private corporation that sells shares on the Hong Kong stock market, MTRC operates on commercial principles, financing and operating railway services that are self-supporting and yield a net return on investment. Effectively, the fully-loaded costs of public-transport investments, operations, and maintenance are covered by supplementing fare and other revenues with income from ancillary real estate development – e.g., the sale of development rights, joint venturing with private real-estate developers, and running retail outlets in and around subway

stations. Hong Kong's government is MTRC's majority stockholder, ensuring the company weighs the broader public interest in its day-to-day decisions. However, the sale of 23% of MTRC's shares to private investors exerts a market discipline, prompting the company to be entrepreneurial. During the 2001-2005 period, property development produced 52 percent of MTRC's revenues. By contrast, railway income, made up mostly of farebox receipts, generated 28 percent of total income. MTRC's involvement in all property-related activities – i.e., development, investment, and management – produced 62 percent of total income, more than twice as much as user fares. An example of an MTRC R+P project that has yielded both high rates of financial returns and high ridership (and thus farebox income) is Maritime Square at the Tsing Yi Station (Figure 9).

Hong Kong has long had tall towers perched above railway stations, however density alone does not make a good TOD. What was often missing was a high-quality pedestrian environment and a sense of place. Most first generation R+P projects featured indistinguishable apartment towers that funneled pedestrian onto busy streets and left it to their own devices to find a way to a subway entrance. Growing discontent over sterile station-area environments and sagging real-estate market performance of older buildings prompted MTRC to pay more attention to principles of good town planning. In 2000 MTRC created a town-planning division within the corporation to pursue land-development strategies that met corporate financial objectives while also enhancing station-area environments. Prior to this, R+P projects followed rather than anticipated development. With an in-house town planning department, MTRC became more pro-active. This has taken the form of the company being ahead of market demand, building high-quality, pedestrian-friendly TODs to steer growth. Research shows the design of high-quality walking environments has yielded even higher financial returns per square meter for R+P projects (Cervero and Murakami, 2009). In Hong Kong, pedestrian-friendly R+P projects have contributed to sustainable urbanism as well as sustainable finance. These benefits have been capitalized into land prices.

9. Conclusion

Global experiences show that under the right conditions, rail transit investments can produce significant land-use changes around rail transit stations. Besides such external, or exogenous, forces as regional economic growth, increasing motorization, and worsening traffic congestion, internal, or endogenous, factors also influence outcomes. Among the policy levers that shape the form and type of station-area development that government officials have at their disposal are: permissive and incentive-based zoning around stations; co-financing, such as the creation of benefit assessment districts to generate income from land appreciation; the ability to target supportive infrastructure and public investments around station areas; and the ability to assemble and purchase land to support to support planned real-estate projects.

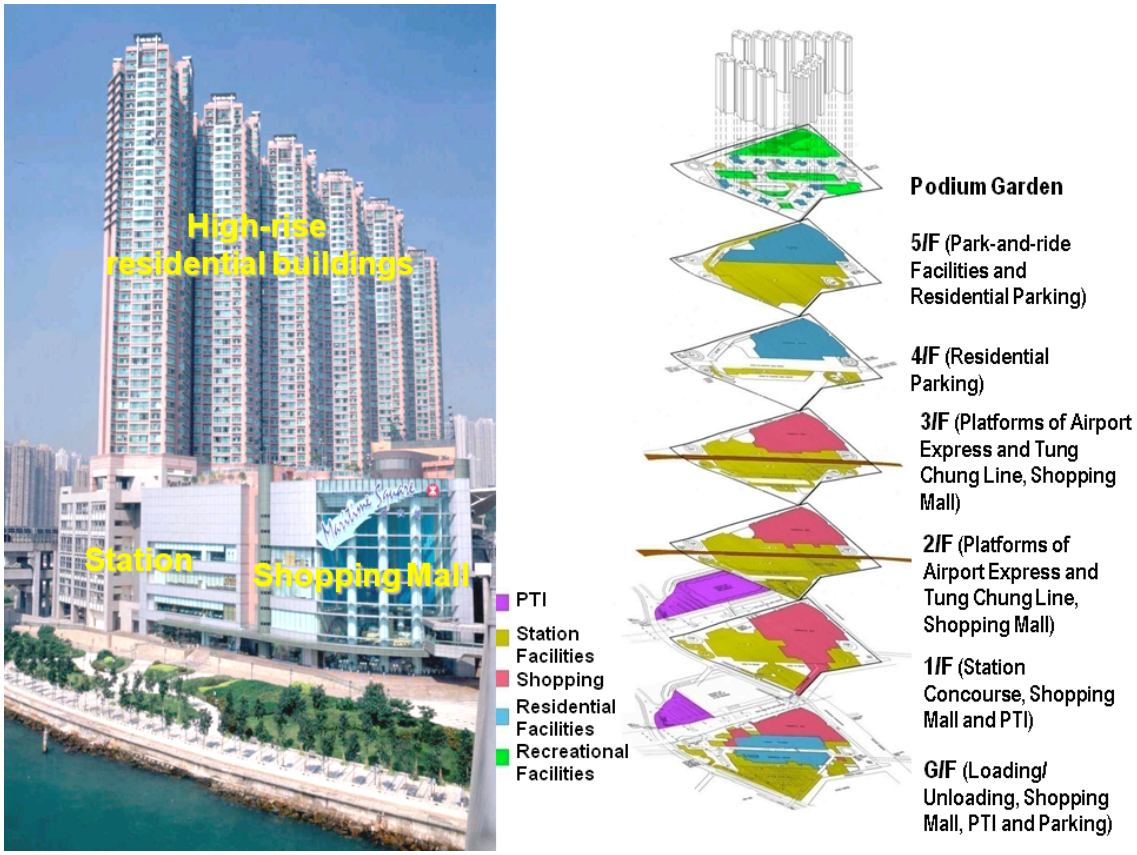

Figure 9. Hong Kong MTR's Maritime Square Residential-Retail Development. Situated above the Tsing Yi Station between central Hong Kong and the new international airport, Maritime Square features hierarchically integrated uses. Shopping mall extends from the ground floor to the 3rd level. Station concourse 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.

While market forces powerfully shape land-use outcomes, experiences from Scandinavian cities like Copenhagen and Stockholm reveal that a cogent regional vision helps considerably in ensuring that railway investments produce desired urban-form outcomes. Experiences from these and other cities suggest that station-area planning needs to be carried out selectively and judiciously. In many settings, and this certainly pertains to Latin America, planning efforts should be devoted to developing or redeveloping a handful of rail stations, at most. This allows resources to be effectively concentrated and increases the odds of a "win-win" arrangement wherein both public and private interests can co-participate in the benefits conferred by new rail investments. Demonstrating that positive land-use changes are possible

in conjunction with a rail investment is important for producing good "models" that the larger development community can emulate as well as convincing banks and lenders that investing in station-area projects can be financially remunerative.

Whether transit-oriented development yields net societal benefits is often revealed by land-price impacts. Accessibility benefits conferred by railway investments get capitalized into land values, presenting railway investors with tremendous opportunities to recapture some of the value created by the investment, at least as a supplement to farebox income and other revenue sources. As reviewed in this paper, east-Asian cities like Tokyo and Hong Kong have been particularly most aggressive at recapturing value through ancillary land development in and around rail stations. There, the logic is value capture and joint development not only generate income to help retire rail-capital investment bonds and finance operations, but they also create market demand that ensures high-ridership services. Hong Kong's version of public-private partnership is not about off-loading the cost of building railways to the private sector. Rather, it is about "co-development" – each sector bringing a natural advantage to the table (e.g., land acquisition powers in the case of the public sector; access to equity capital in the case of the private sector). The resulting "win-win" situation not only leads to financially viable investments, but also an intimate connection between rail systems and nearby real-estate development that attracts tenants, new investors, and transit riders.

Latin American cities are well-positioned to learn from international experiences with rail-induced land-use changes. Importantly, many have the kinds of pre-requisites needed if railway investments are to trigger meaningful land-use changes, including rapid growth, rising real incomes, increased motorization and congestion levels, and the strengthening of government's capacity to enter into constructive joint development deals with the private sector. Indeed, Latin America has been a global leader in drawing in private capital to help finance railway construction, generally with good results. In Buenos Aires and Rio de Janeiro, private financing and construction of metro extensions were accompanied by increased ridership productivity and lower investment costs without a noticeable decline in service quality (Estache et al., 1999; Zegras, 2004). However Latin American cities have yet to move in the direction of cities like Tokyo and Hong Kong in engaging private investors to co-finance capital investments through ancillary land development. Such value capture initiatives could go a long way toward putting Latin American cities on more sustainable pathways – in terms of both facility financing and future patterns of urban development.

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