

RAIL INTEGRATED COMMUNITIES IN TOKYO

by

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ABSTRACT

Tokyo's railway station areas are models of transit-oriented design. To differentiate them from transit-oriented developments (TOD), the term rail integrated community (RIC) has been created to describe these high density, safe, mixed-use, pedestrian-friendly developments around railway stations that act as community hubs, served by frequent, all-day, rail rapid transit and accessed primarily on foot, by bicycle, or by public transit. Japanese private railways have been instrumental in creating these RICs. Though they receive little financial support from the government, private railways in Japan achieve profitability by diversifying into real estate, retail, and numerous other businesses. Tokyu Corporation is used as the case study to exemplify how government policy and socioeconomic context contributed to the successful private railway model. Ten indicators, such as ridership, population density and mode share are used to analyze two stations created by Tokyu to demonstrate how this model is manifested in Tokyu's rail integrated communities.

Keywords: Tokyo, Urban rail, Transit-oriented development, TOD, Private railways, Tokyu, Rail integrated communities, RIC

Subject Terms: Local transit – Japan - Tokyo, Urban transportation – Planning, Land use – Planning, Tokyo - Urban Rail, Tokyo - Transit-Oriented Development, Tokyo - Private Railways

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1. INTRODUCTION

It is difficult to imagine an alternate reality. Could the average North American envisage life without their car?

For the vast majority of those who grew up in the post-war years in North America, the automobile has been the primary mode of transportation. While some may give up the comfort of their vehicle to commute by public transit, almost all other journeys, regardless of the distance, are completed by car. For a trip to visit friends, to the mall, to the local gym, to the restaurant across town, or to go hiking in the mountains, the automobile seems to be the only viable option for most people. Yet in Metropolitan Tokyo these activities are all easily accessible by train at almost any time of the day. Railways are a vital component of the transportation network in the city, and remarkably for the 21st century, all of the private railways in Tokyo Metropolis run profitable operations.

In their attempts to increase ridership and thereby generate greater profits, the private railways have created high density, mixed-use, pedestrian-friendly developments around railway stations that act as community hubs, served by frequent, all-day, rail rapid transit accessed primarily on foot, by bicycle, or by public transit. I have created the term 'rail integrated communities' (RICs) to emphasize how different RICs are from the transit oriented developments (TODs) we see now being developed in North America.

Is there something unique about Japanese society that has created these rail integrated communities? While cultural factors do play a role, I intend to demonstrate that a combination of government policy, socioeconomic factors, and innovation by the private railways have given rise to these communities. Two successful RICs created by Tokyu Corporation, Jiyugaoka and Tama Plaza, are measured on ten indicators to show how differently they function from North American TODs. Tokyu Corporation, one of the first private railways to achieve success through diversification into related businesses, is used as the case study.

The goal is to understand the creation of actual successful RICs as a product of the Japanese private railway model within the socioeconomic context of Tokyo. By showing how RICs have been developed by private railways in Tokyo, I hope to encourage North American transit agencies to begin thinking of ways to become more financially independent in their own cities. In addition, by measuring these RICs empirically, the indicators can help explicate their full range of impacts. It is also hoped that the RICs can be used as examples of the sorts of complete communities that can result from good coordination between transportation and land use.

I begin with an explanation of the benefits of and need for transit oriented developments, discussing why I believe that the rail integrated community model developed in suburban Tokyo is superior to the TOD model seen thus far in North America. I then examine the history of Tokyo and its railways, showing how government policy and the initiative of the private railways

built a dense rail network prior to the rise of the automobile in Japan in the mid-1960s. The extent of automobile usage in Tokyo and Japan is then examined. Next, a case study of Tokyu Corporation details how this private railway has achieved its enviable profitability and high ridership. After outlining my methodology and data collection methods, I present ten indicators for Jiyugaoka and Tama Plaza, set within the context of the Japanese city. I conclude by summarizing my findings, discussing the limitations of my research, suggesting further research in this area, and finally looking at possible lessons for North American transit agencies from the Japanese private railway model.

Japan's private rail operators were forced by nationalization of their trunk railway lines in the early 20th century to look beyond railway operations for profits. In contrast, in North America, a lack of diversification by most street railways led to the demise when faced with competition from the automobile. Government regulation of fares coupled with limited subsidies for railway operations pushed the private railways to innovate and diversify into a wide variety of related businesses, most notably real estate. Due to their long-term interest in the communities they build along their rail lines, the private railways have provided valuable social benefits through public transportation while still pursuing profits. High quality, frequent rail service serving dense, mixed-use, safe, pedestrian-friendly developments have allowed Tokyoites to achieve enviable rates of public transit usage and the freedom to make buying an automobile a lifestyle choice rather than a necessity.

2. THE RATIONALE FOR RAIL INTEGRATED COMMUNITIES

In this section I will provide a background to the concept of transit oriented developments (TODs), look at the benefits of TODs, and consider the future demand for these types of communities. I then look at the reality of TODs and transit-adjacent developments (TADs) in North America and contrast them with the rail integrated community (RIC) model that is a part of life in Tokyo.

2.1 The concept of transit oriented developments (TODs)

Transit-Oriented Developments (TOD) are defined by Dittmar & Ohland (2004, p. 4) as "...mixed use, walkable, location-efficient developments that balance the need for sufficient density to support convenient transit service with the scale of the adjacent community". Bernick & Cervero (1996, p. 5) extend this idea in their transit village concept, "...a compact, mixed-use community, centred around the transit station that, by design, invites residents, workers, and shoppers to drive their cars less and ride mass transit more." The radius of the transit village is about 500 metres from the station, or a little over 5 minutes on foot (Vuchic, 2005; O-heya Sagashi Tatsujin, 2009). TODs have been a popular concept in North America for about the last 15 years, beginning with the founding of the Congress of New Urbanism in 1993 by architects such as Peter Calthorpe and Andres Duany. Indeed, these and other new urbanist architects have been the prime movers behind new developments along transit lines, which have

sprung up in places like the San Francisco Bay area, Portland, Oregon, and in Denver, Colorado.

2.2 The benefits of TODs

More TODs are slated to be built as part of the boom in construction of new light rail and streetcar lines in North American cities that started over 20 years ago. The benefits of TODs are myriad: vibrant, walkable communities; increased density which saves valuable agricultural land; increased transit ridership; reinforcement of the link between transportation and land use; reduced need to drive, resulting in fewer automobile-related accidents; improved access for seniors and those with disabilities; a reduction in greenhouse gas emissions with fewer cars on the road; a healthier population with more residents walking and cycling; and shorter commute times.

Studies have shown that public transportation and walking are interdependent and complementary modes (Pucher, 2004). Countries in which public transit has a high mode share¹ also have a high mode share for walking. The World Health Organization has found that public transportation is associated with higher levels of physical activity and lower levels of obesity (Ibid). Obesity rates in countries where walking and cycling make up between one third and one half of all urban trips are much lower than where the automobile is dominant. The average obesity rate in Europe is only 6%, compared to 30% in the United States (OECD, 2006) and 23% in Canada (CBC, 2005). Japan's obesity rate is only 3%

¹ Mode share is the percentage share that a particular type of transportation mode has in relation to other modes.

(OECD, 2006). TODs have great potential for reducing automobile dependence and thereby increasing physical activity. Even in the most spread out metropolitan areas of the U.S., 41% of all trips are shorter than 3 km, and 28% are shorter than 1.6 km (Pucher & Renne, 2003). In a pedestrian and cycling friendly environment most people can easily cycle 3 km or walk 1.6 km (Pucher & Dijkstra, 2000).

As well, especially in times of economic hardship, household budgets can be significantly reduced by choosing transit over the automobile. Reconnecting America, a non-profit organization that works to integrate transportation systems and the communities they serve, has found that those living in transit-friendly neighbourhoods spend only 9% of their incomes on transportation, compared with 25% in auto-dependent locations (Schmitz, 2009).² The American Public Transportation Association found that the amount saved by the average person using transit rather than driving to be around \$8,400 USD per year (Ibid). Another benefit for homeowners is that homes in TOD developments seem to keep their value better when compared with the rest of the housing market. After the opening of the southeast light rail line in Denver in November 2006, homes near the line increased by an average of 4% over two years, while prices decreased by an average of 7.5% in the rest of the Denver market (Jackson, 2008).

² In Japan, an average of a mere 1.1% of the yearly household budget is spent on rail transportation and 0.2% on buses, compared to 6.9% spent on the automobile (Japanese Private Railway Association, 2006).

2.3 Demand for TODs

Demand for these transit oriented developments is expected to increase due to factors such as the long commute times of automobile-centric cities, an aging population, concerns about automobile pollution, and the increasing number of people who want to live in walkable, mixed-use communities. As well, the peaking of world oil production in the next 20 years will likely create a “...severe liquid fuels problem for the transportation sector” (Hirsch, Bezdek, & Wendling, 2005, p.6) as well as dramatically higher oil prices that will make automobiles use more expensive (Gilbert & Perl, 2008). Post (2007, p. 145) comments that “In our own time it seems increasingly unlikely that all other things will remain equal, and especially not an abundant and cheap supply of the liquid hydrocarbon that fuels automobility.” More travel by energy efficient rail will mitigate these effects, as it is more than twice as carbon-efficient as automobile travel and short-haul flying (May, 2008).

Demographic trends are also favourable to the development of TODs, with Cervero et al (2002) listing three: an increase in childless couples and young urban professionals wanting to live in the central city, both of whom need less space; more elderly households that are moving to smaller residences with good access to transit; and more immigrants from countries with traditions of transit use and compact neighbourhoods. High quality, frequent rail transit also encourages commuters to use transit. Cervero (1994) found that residents in the San Francisco Bay area that lived in cities served by BART (Bay Area Rapid

Transit) were five times more likely to commute by transit than a typical commuter of the area.

2.4 North American TODs and TADs

There is therefore a need to build high quality TODs that will allow more people to access transit in combination with short walking or cycling trips, making it possible to reduce or even eliminate automobile use in daily life. However, the success of recently constructed TODs in North America has so far been mixed. While the communities themselves are indeed walkable, often they are not complete communities that provide jobs, schools, services, retail, entertainment, and recreation. Some of these developments go by the term transit-*proximate* development or transit-*adjacent* development (TAD), to identify them as walkable communities that contain features that encourage public transit use.

For those living in these North American TODs and TADs, the underlying assumption seems to be that residents will perhaps commute by train, but use their cars for most other tasks, including getting to and from the station. Outside of working hours, frequency of transit service drops significantly, making it unlikely that transit will be used by discretionary riders who have their own vehicles. Suburban TODs often include large parking lots so that residents can use their cars as soon as they reach their station. Even riders who would like to walk or bike home are dissuaded from doing so, due to unattractive, desolate and often unsafe station areas that lack any shops or services, access roads without sidewalks or bike paths alongside, and the long distances involved as a result of single-use zoning that separates shops and services from residences.

Furthermore, these TODs are usually missing the morning-to-night vibrancy that is produced when a wide range of uses come together in an area with high population density and low automobile usage.

Although transit oriented developments in North American suburbs may increase transit usage to an extent, in their current form they are not likely to reduce automobile dependence. Truly successful developments near public transit need to be based on the idea that those living in such a community should easily be able to conduct all of their daily business using public transit. This means that the transit system as well as the surrounding neighbourhoods can easily accommodate those without an automobile. This is not what is being built in most of North America. A better model can be found in Tokyo, Japan, which has the expertise that comes from almost 100 years of building these kinds of developments.

2.5 Why Tokyo?

Tokyo has one of the most well-used rail networks in the world, providing frequent, all-day service to the central city and also *within* the suburbs, which most North American cities don't have. The urban villages surrounding the stations provide riders for the system, as well as being destinations in and of themselves. These areas are invariably mixed-use, with stores, schools and universities, government offices, housing, restaurants, and bars all located within walking distance from the stations.

It is somewhat surprising that a city with a metro population of 35.7 million (UN, 2007) in which fewer than 30% of the people commute by automobile

(Ministry of Land, Infrastructure, Transport, and Tourism, 1999) has received comparatively little attention for its station area developments. Research to date has been overwhelmingly focused on the United States, Canada, Australia, or the countries of Western Europe. Perhaps this is due to the perception that Japanese society is fundamentally different from that of other countries, so it is assumed that its successes cannot be replicated elsewhere. Or it may be simply be the general tendency of researchers to look at countries they are more familiar with. In any case, much can be learned from the way that private railway companies in Japan have been able to maintain consistent profitability, something unheard of for most other transit operators, save a few agencies like the Hong Kong MTR subway³.

2.6 Rail integrated communities (RICs)

In Japanese metropolitan areas like Tokyo, automobile ownership is not essential, since all aspects of daily life can be conducted by taking a train, bus, bicycle, or travelling on foot. Employment, entertainment, shopping, and government services are all clustered around train stations, rendering the automobile almost unnecessary. Population densities, ridership, and transit mode share are high, property values increase with proximity to the station, land uses are mixed, the access mode to the station is usually either walking or by bicycle, automobile parking is limited but bicycle parking is plentiful, and the transit

³ Net profits for the Hong Kong MTR subway in 2007 were 8.57 billion Hong Kong dollars, or \$1.1 billion USD. Fare revenue was 66.6% of overall revenue (MTR, 2008).

system has a high quality and frequency of service from early morning until late at night. Train stations are the centre of life for the surrounding community.

Since these developments are so fundamentally different from TODs, I have created a term to describe them: rail integrated communities, or RICs. These are high density, safe, mixed-use, pedestrian-friendly developments around railway stations that act as community hubs, served by frequent, all-day, rail rapid transit accessed primarily on foot, by bicycle, or by public transit. A well-functioning RIC requires not only attention to the physical form when constructing the station and surrounding neighbourhoods, but also the creation of government policies that help the transit provider thrive over the long term through funding sources other than the farebox. The Japanese private railways that have built most of these RICs have adopted forward-thinking strategies to not only build ridership but also develop other revenue streams. They not only receive revenue through fares, but also create revenue through other sources such as real estate development, retail sales, advertising, and other ancillary businesses such as travel agencies. These profits then help to provide increased and expanded service for their riders.

Shoji (2001) notes that there is the expectation that urban public transit systems should both serve the public interest and be profitable. Unfortunately, the focus on the former, while achieving low fares, has led to inefficiencies in management and operations in North America. On the other hand, profitability seems to be viewed as an unachievable goal which is nonetheless pursued almost exclusively through the farebox. Perhaps it is time to engage the private

sector to help make public transit more competitive with the automobile and to become partners in developing more transit-friendly communities. This leads us to the model of the Japanese private railways, which provide excellent public transit thanks partly to government policies and regulations that encourage public transit use and discourage the use of automobiles, and partly to their own initiative in operating efficient, diversified organizations.

3. METHODOLOGY SUMMARY

I have used a multi-method approach (Babbie & Benaquisto, 2002), gathering data through books, journal and magazine articles, statistical databases, and email questionnaires. I visited Tokyo from May 1st to 24th, 2008, conducting research at the National Diet Library, purchasing books from the extensive rail collection of the Shosen Grande bookstore in Jimbocho, talking with Tokyu Corporation staff, photographing and documenting Jiyugaoka and Tama Plaza stations, and meeting with planning staff from Setagaya Ward Office. I was able to access numerous Japanese-language books, websites, and reports that were invaluable in creating a detailed understanding of RICs in Tokyo. As mentioned earlier, Tokyo's RICs have not often been examined in great detail in English language research, I think partly due to the language barrier. It was vitally important, therefore, for me to make personal contacts to find good sources of information as well as to meet with respondents whom I could call on once I returned home. As well, since the Japanese private railway model is fundamentally different from the way mass transit works in most other countries in the world, the real-world effects of policy decisions and government regulations needed to be quantified and confirmed.

The information has been used to show how government policy, the Japanese private railway model, and the socioeconomic context in Japan have created well-integrated, safe, aesthetically pleasing, and economically viable rail

integrated communities in Tokyo. In order to build the case for RICs and provide a more detailed picture of how the Tokyo transit model works on the ground, Tokyu Corporation (*Tokyo Kyuko Dentetsu Kabushiki-gaisha*) has been used as a case study of the private railway model in Japan in its most successful form.

Through my knowledge of Tokyo train stations, magazine articles, station area liveability ratings, discussions with Tokyu staff, and a desire to highlight RICs built in Tokyo in two different eras, Jiyugaoka and Tama Plaza stations were selected for in-depth reviews. These are paradigmatic cases which exemplify what is possible. Kawasaki (1993) notes that while there is little individuality among Tokyo's suburban towns, he singles out Jiyugaoka and Tama Plaza (as well as Shimokitazawa and Kichijoji) as having an individual character owing to their formal planning and development by Tokyu Corporation. As well, only Jiyugaoka and Tama Plaza of the four are developments developed and serviced exclusively by a single private railway company.

These stations and their surrounding areas were analyzed qualitatively and quantitatively using indicators developed by the Transportation Research Board (2005) and the Planning and Transport Research Centre in Western Australia (Government of Western Australia, 2006). Although area coverage is normally computed as the area within a five-minute walk, or a 400 metre radius of a railway station, because station buildings usually spread out 100 metres or more, area coverage for rail systems is often given by a 500 metre radius (Vuchic, 2005), which is what I will use for this analysis.

4. TOKYO, AND THE SOCIOECONOMIC CONTEXT FOR RAIL TRANSIT

This section provides an overview of Tokyo's recent history, in particular how the rapid urbanization of Japan impacted Tokyo, causing it to overflow its original boundaries and suburbanize in almost every direction. This was not, however, to be a North-American style suburbanization. The auto-centred lifestyle arrived much later in Japan than in most other developed countries, and its impact was mitigated by government policies that have made car ownership a luxury.

4.1 Largest city and Japan's economic engine

Tokyo Metropolis (*Tokyo-to*) has a population of 12.9 million stretched across the 23 wards⁴ of the central city and 26 suburban municipalities of the Tama area⁵ (Fig. 1) that cover the western half of the city (Tokyo Metropolitan Government, 2009). The 23 wards make up the original city of Tokyo, and hold a population of 8.75 million, or 68% of the total. The commuting zone is much larger, stretching out to a radius of about 50 kilometres from the centre of the City, a total area of 10,117 square kilometres. Called the Tokyo Metropolitan Area (TMA) or *Shutoken*⁶, it holds 35.7 million people (UN, 2007), more than the

⁴ In Japanese the 23 wards are called either *Tokyo-to Kubu*, *Tokubetsu Kubu* (special wards), or *Tokyo 23-ku* (Tokyo 23 wards). In this study they will be referred to as the 23 wards.

⁵ In Japanese *Tama Chiiki*, *Tama Chiku*, or *San-Tama*

⁶ Other names are *Tokyo-ken* and *Tokyo Toshi-ken*

Figure 1: Map of Tokyo Metropolis



The purple area shows the 23 wards of Tokyo, while the green is the Tama area, with 26 cities, three towns, and one village. The remaining two towns and seven villages, not shown, are located on the Izu and Ogasawara islands to the south.

Source: Tokyo Metropolitan Government, 2008a

population of Canada⁷. It is the largest urban agglomeration in the world (City Mayors Statistics, 2005), spreading over the prefectures (administrative districts) of Tokyo, Kanagawa in the southwest, Chiba in the east, and Saitama in the north, as well as parts of other neighbouring prefectures.

The TMA accounts for 28% of Japan's population and 28% of its GDP (City Mayors Statistics, 2005) while covering only 3.5% of the land area of Japan (Morichi, 2000, p. 611). As Fujita and Hill (1993, p. 9) note:

“Tokyo is at once a global command centre for corporate headquarters, the centre of gravity for high technology industries, and a regional milieu that encourages small firms to coalesce into flexible production networks. In short, greater Tokyo is Japan's version of the City of London, Silicon Valley, and the “Third Italy” all wrapped up into one dynamic region”.

⁷ Canada's population in October 2008 was estimated at 33.4 million (Statistics Canada, 2008a)

Workers come to Tokyo from all over Japan due to this extraordinary centralization of functions in the nation's capital. While Tokyo's overwhelming dominance came relatively late in its history, even in the 18th century it was the world's largest city (Karan, p.2, 1997).

4.2 Suburbanization in Tokyo, urbanization in Japan

Prior to the Industrial Revolution, the population of Japan was quite evenly distributed across the country, but migration to the cities increased dramatically at the start of the 20th century. Tokyo's population jumped from 831,000 in 1875 to 2.2 million in 1909 (Fujita & Hill, 1993). Increasing military expenditures in the 1930s strengthened the bond between business and government, and the "...high degree of regulatory authority possessed by the central government attracted Japan's corporate headquarters to Tokyo" (Ibid, p.8).

The Garden City movement, first developed in England, had a profound influence on Japanese urbanization after World War I. While investment was often inadequate to create full Garden City developments, the influence of this movement did cause the city to sprawl far beyond its previous confines of the 23 wards, especially to the Tama area in the west of the city (Masai, 1970). Another reason for this population shift was the impact of the Great Kanto earthquake of 1923, which created a desire in Tokyo's citizens to move away from the devastation of the central city (Ibid). Interestingly, while Tokyo today is thought of

as a very dense city, the population density in the 23 wards has actually *decreased* since the end of the feudal age due to this suburban shift.⁸

In 1944 and 1945, much of the city was destroyed by aerial incendiary bombing runs by the U.S. military. Hardest hit was the eastern part of the city, where most of the factories were located. About 16,000 hectares and 770,000 homes were destroyed, representing almost 40 percent of the city (Hiroo, 2003, p. 50). This further encouraged Tokyo's citizens to move away from the central city and into suburban developments. The economic boom after the war fuelled rapid development, which generally lacked coherence and logical order and furthered the mixing of land uses. Large public apartment complexes, or *danchi*, were built to meet the rapidly growing demand for housing. As the *danchi* were almost always constructed in the suburbs, it helped strengthen the pattern of commuting from suburb to central city in Tokyo (Ibid, p. 55).

Prior to World War II, most Tokyoites lived within a fifteen-kilometre radius of the city, but by 1975 the Tokyo Metropolitan Area had spread out to a radius of thirty kilometres, and by the late 1980s the commuting zone had increased by another twenty to thirty kilometres (Morichi, 2000). Central Tokyo makes up one-third and the 23 wards a full 81% of all jobs in the region (Cervero, 1998), so morning commutes are very crowded. Commuters travelling to central Tokyo doubled between 1960 and 1970 and one-way commute times tripled from twenty minutes to 60 minutes (Ibid). From 1.6 million in 1970, the number of people commuting into the 23 wards jumped to 2.6 million in 1985, then more

⁸ The population density in the 23 wards dropped from an average of 20,000 per km² in 1870 to 10,000 per km² in 1970 (Masai, 1970), rebounding to 14,061 per km² in 2008 (TMG, 2008).

than doubled to over 5.5 million by 2000 (Morichi, 2000). The average commute time⁹ is now 54 minutes for those living in the 23 wards and 59 minutes for Tokyo Metropolis (Ministry of Land, Infrastructure, Transport, and Tourism, 2005a). About one in four commuters in Tokyo Metropolis travel more than 90 minutes from home to work (Kagoshima, 2002).

Tokyo and other major metropolitan areas attracted huge numbers of people moving in from rural parts of the country. The peak of migration from Japan's rural areas into Tokyo was in 1962, the pace of growth slowing by the late 1960s (Karan, 1997, p. 22). While in 1945 only 28% of Japanese lived in cities, just 25 years later this figure had jumped to 72% (Fujita & Hill, 1993). While half the population in 1950 was either farmers or fisherman, this number had dropped to less than 10 percent by 1980 (Tabb, 1995). The extensive migration to the city from 1955 to 1965 meant that over half of Japan's prefectures lost population and another quarter grew at less than one percent per year (Fujita & Hill, 1993). In only two generations, the high-technology, urban economy took over from the rural economy in an economic ascent dubbed the "Japanese Miracle". Japan had reached the same level of urbanization in 25 years that had taken 100 years in the United States (Ibid).

Due to the rising land prices in the 1970s and 1980s, Tokyo's 23 wards began losing population to the suburbs. The impact was greatest on the seven central wards, located mostly within the Yamanote line¹⁰, where population

⁹ In Japan as a whole, the average commute time is 34 minutes (Ministry of Internal Affairs and Communications, 2003)

¹⁰ The Yamanote Line is a loop line that circles central Tokyo, connecting many of Tokyo's major stations. One loop takes about one hour.

declined by 9% between 1985 and 1990 (Karan, 1997). In an effort to bring residents back to the central city, the Tokyo city government revised its City Planning Law in 1992 to increase the number of zoning types from 8 to 12, adding residential zones that allow for exclusive high-rise residential districts¹¹ (ibid). More people began to move to the central city; between 1998 and 2003 the second highest percentage increase in dwellings was 0 to 10 km from the city centre¹² (Ministry of Internal Affairs and Communications, 2003). New developments such as Roppongi Hills and Tokyo Midtown have added caché to living in the central city, resulting in a 7.5% increase in population in the 23 wards between 2000 and 2008¹³ (Tokyo Metropolitan Government, 2008b). In addition, taxes on farmland were increased in 1988 in areas designated for ‘urban promotion’ to allow more land to be used for housing (Karan, 1997). Unfortunately, with Tokyo already suffering a lack of green space¹⁴, the loss of urban farmland has eliminated some of the few open spaces left in many neighbourhoods.

¹¹ Until very recently, Tokyo was a comparatively low-rise city, especially considering the huge population it must fit in such a small area. The average height of buildings in the City of Tokyo was a mere 1.7 stories in 1970 (Masai, 1970, p. 99), mainly due to height restrictions. With a relaxation in height laws in recent years, average height rose to 4 stories by 2006 (Yasunobu, 2006).

¹² There was an 11.4% increase in dwellings 0 to 10 km away from the city centre, while the highest increase (11.8%) was in dwellings 30 to 40 km away. The lowest increase was for dwellings 60 to 70 km away from the centre (Ministry of Internal Affairs and Communications, 2003).

¹³ The seven central wards experienced a 15.2% population increase over the same period, with Chuo ward the highest increase at 54% (Tokyo Metropolitan Government, 2008b).

¹⁴ Tokyo has an average of only 4 m² of public park per inhabitant, which is very low compared with cities like Paris (12 m²), Vancouver (27 m²) and New York City (29 m²) (Tokyo Metropolitan Government, 2008)

4.3 A relative latecomer: the automobile

4.3.1 A late start to road building

The development of a domestic automobile industry, which began with the founding of Toyota and Nissan in the mid-1930s, was disrupted by World War II (Japan Automobile Manufacturers Association, 1995a). Production dropped by half as steel and other important materials became difficult to procure (Ibid). As late as 1956, a World Bank survey on highway construction observed that "...no other industrialized country besides Japan has neglected its road network so badly", with only 2% of Japan's road network paved (Japan Automobile Manufacturers Association, 1995b). Even as late as 1964, this had only increased to 3.9%, with just 181 km of paved highways (Ibid). Japan's highway building era began with the completion of the country's first freeway, the Meishin expressway between Kobe and Nagoya, in 1965 (Matsumoto & Kosuda, 2005) and initial planning on extending Japan's highway network a year later (Japan Automobile Manufacturers Association, 1995b).¹⁵

This delayed start in paving roads and building freeways, as well as reduction in intercity travel times resulting from the 1964 introduction of the Shinkansen, meant that rail was still the preferred mode of transportation in Japan much later than in North America, where the automobile had made major inroads in the first decades of the 20th century. In contrast, "as early as 1922, 135,000 suburban dwellings in 60 metropolises (in the U.S.) were completely dependent on motor vehicles" (Muller, 2004, p.70). Not only did the automobile

¹⁵ The second freeway constructed was the Tomei Expressway connecting Tokyo with Nagoya, which opened in 1969 (Matsumoto & Kosuda, 2005).

take away passengers from railway companies in North America, it also “...encouraged the opening of unbuilt areas lying between suburban rail axes...” (Ibid) and enticed residential developers away from building near rail corridors. As a result, the developers also stopped subsidizing the streetcar companies to provide cheap access to their new housing (Ibid). As well, while streetcar companies had shared the cost of paving roads with municipalities when laying new track, automobile companies and drivers didn’t, which kept the cost of an automobile artificially low (Ohland & Poticha, 2007).

Japanese consumers eventually did begin buying large numbers of cars: the number of vehicles in Japan rose from 8 million in 1965 to 23 million in 1975, and 48 million in 1985 (Aoki et al., 2000). As a result, automobile travel surged by 158% between 1970 and 1990 (Perl, 2002). Publicly owned Japan Rail was hit the hardest, as it ran mainly intercity routes, while the private railways posted a 28% increase in passenger-miles over the same period, since they focused on regional and commuter services in growing metropolitan areas (Ibid). In 2006, automobile use totalled 947.6 billion passenger-km while passenger traffic on railways was 385.2 billion passenger-km (Masumoto & Kosuda, 2005).

However, recent evidence points to Japanese buying fewer automobiles, reflecting the economic slump that Japan has been in since the early 1990s and increased gasoline prices. Automobile sales are predicted to drop below 5 million units per year for the first time in over three decades, and projected sales for 2009 were the lowest since 1980 (Kageyama, 2009). Sales have dropped by half since 1990, and a 2008 survey by the business newspaper Nikkei found that only

25% of Japanese men in their 20s even wanted to purchase a car, compared with 48% in 2000 (New York Times, 2009). For Japanese urban dwellers, it is possible to give up the idea of owning an automobile without sacrificing one's lifestyle thanks to the excellent rail system in the cities.

4.3.2 Fewer automobiles and less driving

Until quite recently, the number of private automobiles per capita in Japan was very low. Between 1960 and 1980 the number of automobiles jumped from just 5 per 1,000 people to 210 per 1,000 people (Jones, 1983), and has since more than doubled to 543 per 1,000 people¹⁶ (Baig, 2008). This is still lower than the U.S. (765 per thousand) and Canada (561 per thousand), but higher than the UK (426 per thousand) (Ibid). The number of passenger vehicles per household in Japan increased steadily from 0.48 in 1975 to 1.1 per household in 2001, holding at about the same rate since then (Ibid).

And Japanese don't drive as much as in many other countries. In 2006 the Victoria Transport Policy Institute (VTPI) compared countries' annual vehicle travel by automobile and found that the average in Japan was 6,602 km per capita compared to 23,095 km per capita in the U.S., 11,614 in the U.K., and 15,169 in Canada. Automobiles still consume 88.1% of energy expended on passenger transport in Japan even though they take up 61% of transportation volume (Energy Conservation Centre Japan, 2002). On the other hand,

¹⁶ In contrast to passenger vehicles, the ownership rate of commercial vehicles in Japan is the world's highest at 184 per 1,000 people (Asano, 1998), as freight transport by rail has declined significantly in Japan in recent decades.

passenger rail transportation uses only 3.3% of passenger transport energy, while holding 26.8% of transportation volume (Ibid).

Although there are 4.62 million licensed automobiles in Tokyo, the most of any prefecture, it has the lowest per capita rate in Japan at 365 vehicles per 1,000 people (Tokyo Metropolitan Government, 2006). This is a decrease from 383 per 1,000 people in 2000, even as population has increased by 700,000 people between 2000 and 2006 (Ibid). As well, Tokyo Metropolis ranked 47th out of 47 prefectures¹⁷ for the number of passenger vehicles per household, with a figure of 0.52 (AIRIA, 2007). The number of *private* automobiles per capita (excluding company cars and taxis) is even lower, at 250 vehicles per thousand people (Ibid). In comparison, the number of automobiles per 1,000 people was 560 in the Toronto region, 430 in Montreal, and 610 in Vancouver. The number of automobiles has put pressure on Tokyo's limited land area, and is compounded by the fact that many streets in Tokyo are still the same 4 metre width as when they were built in the days before the automobile, making driving on side streets a challenge.

4.3.3 Reasons why the Japanese drive less

Jones (1983) found that there is "...a fundamentally different attitude toward car ownership and use..." in Japan (1983, p. 6). He determined the factors to be:

¹⁷ Tokyo's neighbouring prefectures were also at the low end of the scale: Kanagawa Prefecture (45th, 0.80); Chiba Prefecture (41st, 1.06); Saitama Prefecture (38th, 1.07) (AIRIA, 2007)

- A tradition of restricting mobility by road during the Tokugawa rule up to 1868, and the subsequent limited rate of growth of the road network in comparison with some other industrialized countries
- Good public transit
- The regulation that car owners must own or rent a parking space for their vehicle¹⁸, coupled with the high cost of land that raises the price of these spaces¹⁹
- On-street parking is very limited in most cities, and employers don't generally provide free parking²⁰
- The time and expense of obtaining a driver's licence²¹
- Payment of commuting expenses by employers, but generally only for public transit, not private car

Cervero (1998) states that the Japanese government imposes strict controls on automobile ownership because of Japan's limited land area and lack of domestic oil reserves. Vehicle taxes include "...a commodity tax on manufacturers and three taxes on purchasers: a vehicle acquisition (excise) tax, an annual automobile (registration) tax, and a surcharge based on vehicle weight" (Cervero, 1998). In addition, gasoline taxes are two to three times those of North America, with the price of gasoline per litre \$1.26 USD²² versus \$0.54 in the U.S. and \$0.68 in Canada (VTPI, 2006). There is also a mandatory vehicle

¹⁸ Car owners must prove they own a parking space before they can buy a car, unless the car is less than 3.4 metres long with an engine no larger than 660cc (Colliers International, 2008).

¹⁹ As recently as 2004, the average monthly charge for condominium parking was 24,250 yen (\$250 USD / €195 Euro) in Tokyo Metropolis and 19,175 yen (\$195 USD / €155 Euro) in the TMA (Hosono, 2004).

²⁰ The average monthly cost for pay parking lots in Tokyo Metropolis in 2008 was 49,000 yen (\$500 USD / €395 Euro) (Colliers International, 2008).

²¹ Japanese drivers must pass written, practical, and physical (eye exam, etc.) tests to receive their driver's license. It is usually necessary to attend a driving school to pass the practical test, where courses typically cost at least 300,000 yen (\$3,075 USD / €2,425 Euro) (Fukuoka International Association, 2006).

²² Average gasoline prices in Japan are closer to European countries like Spain (\$1.21) and Ireland (\$1.29) (VTPI, 2006).

inspection program called the *sha-ken*²³, for vehicles with engines over 250cc. This is exorbitantly expensive, costing between 49,000 to 150,000 yen (\$490 to \$1,500 USD or €370 to €1,125 Euro) each time, and is conducted every 1 to 2 years depending on the vehicle type and use (Ministry of Land, Infrastructure, Transport, and Tourism, 2002). In addition, all expressways in Tokyo are toll roads (Cervero, 1998). And while Japan has now caught up with freeway building in the rest of the world²⁴, Japan's expressway tolls are among the most expensive in the world, charging double the tolls of European freeways.²⁵ If we average the total cost of buying a new car, as well as gasoline, taxes, and inspection fees over nine years, it works out to 50,000 yen (\$500 USD or €400 Euro) per month, or 600,000 yen (\$6,000 USD or €4,600 Euro) per year in a country where many employees make three to four million yen per year²⁶ (Railway Town Development Conference, 2004).

These factors have meant that only 64 million people, about half the population, hold driver's licenses (Asano, 1998). Fewer drivers also mean lower energy transportation energy use per capita. Japan uses only 0.73 per capita tonnes gasoline equivalent compared to 2.18 in the U.S., 1.72 in Canada, and 0.90 in the U.K. (VTPI, 2006).

One has to be prepared to spend a great deal of money to buy and own an automobile in Tokyo, which contributes to the popularity of public transit.

²³ Formally, the *jidousha kensa touroku seido* (Automobile inspection registration system)

²⁴ In 2005, Japan had 0.058 freeway-km per person, about the same as the U.K. with 0.059. Germany is more than double this number (0.146) while the U.S. has 0.253 freeway-km per person (Japan Road Association, 2005).

²⁵ Tolls in Japan average 25 yen (\$0.25 USD or €0.19 Euro) per km, compared with 11 yen per km in France and 7 yen per km in Italy (Nagata, 2008).

²⁶ This works out an automobile costing 15~20% of total wages per year.

Some consider the private railways to be almost regional monopolies, due to the high cost of owning an automobile, which forces commuters to board rush hour trains (Mizutani, 1994). With the Tokyo private railway market divided into 'territories' that are generally operated by one company, commuters have little option but to use the line in their area (Ieda et al, 2001). And while high average load factors during peak periods may reduce costs, it may also be a sign that the railways are abusing their monopoly position by not increasing service quality (Ibid).

The low rates of automobile usage and a compact urban form have created the broader socioeconomic conditions for the success of Japan's private railways. However, we also need to understand how Japan's private railways were poised to take advantage of these conditions to achieve success, unlike those in North America which remain dominated by government-owned transit systems.

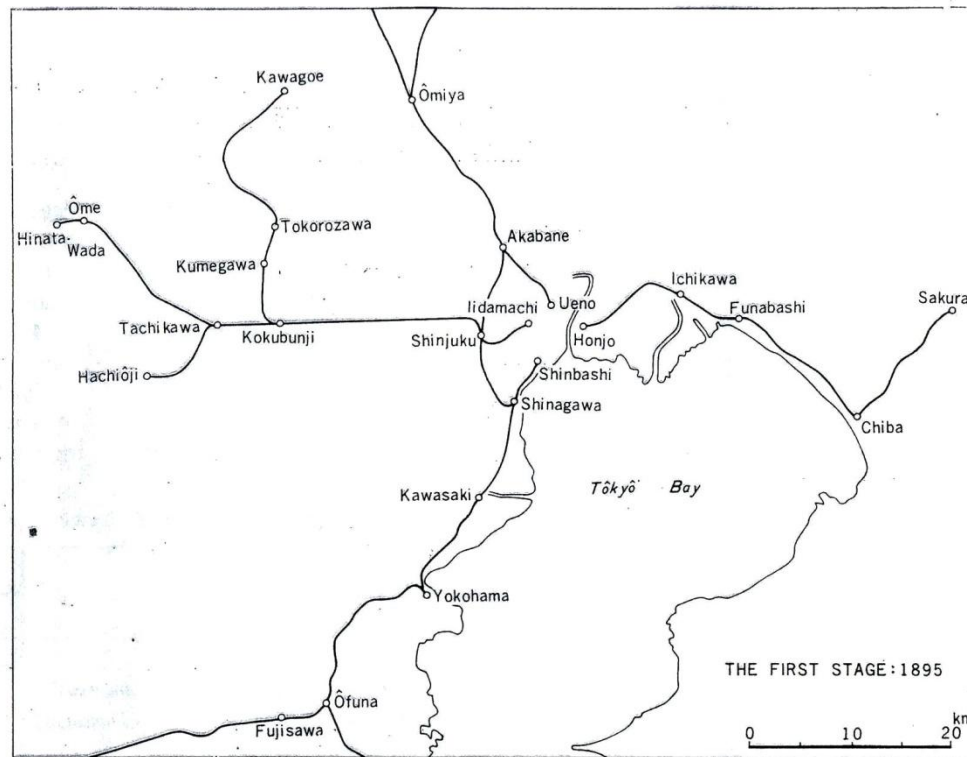
5. JAPAN'S PRIVATE RAILWAYS

Private railways have played a vital role in creating in Japan one of the world's densest railway networks. In a country that has firmly embraced the automobile, the continued success of private railways stems from a combination of government policy and entrepreneurial spirit that pioneered a strategy of diversification into mutually supportive, related groups of companies. While Tokyu Corporation wasn't the first organization to adopt this approach, it has arguably been the most adept at exploiting it.

5.1 History of rail in Tokyo: 1872 to the present

Japan's first railway opened in 1872, built by the Japanese government using British technology to run steam engines between Tokyo and Yokohama. Japan Railway (*Nihon Tetsudo*), the first private railway in Japan, was founded in 1883 (Mizutani, 1994). While the growth of the interurban railway network was tepid for the next 10 years, construction boomed in the latter half of the 1880s, and by 1900 the network extended to most areas of Japan (Fujita and Hill, 1993). This rapid expansion of the railway network was fuelled by an equally rapid urbanization taking place around the country resulting from "...the abolition of restrictions on migration and occupational choice" in the early Meiji era (Fujita and Hill, 1993, p. 31). As early as 1893, Japan had 3,010 km of railways, of which 2,125 km were private and 885 km were government-owned (Aoki et al., 2000). The extent of Tokyo's intercity network by 1895 can be seen in Fig. 2.

Figure 2: The Tokyo railway network in 1895



Source: Arisue & Aoki, 1970, p. 192

However, rail as a means of *intraurban* transport didn't take off until the advent of electric streetcars at the turn of the 20th century. Three private companies opened lines between 1903 and 1904, amalgamating into a company called the Tokyo Railway, which was eventually bought by the Tokyo municipal government in 1911 (Arisue, 1970). Also around this time, private railway companies began operating suburban streetcar lines, mainly on the west side of the city (See Appendix A for a list of the early streetcar companies).

In March of 1906, the national government passed the Railway Nationalization Act (*Tetsudo Kokuyu-ho*), nationalizing 17 of the 37 existing private railways between 1906 and 1907, and electrifying these lines over the next few years (Aoki, 1994). Its purpose was to "...smooth domestic transport,

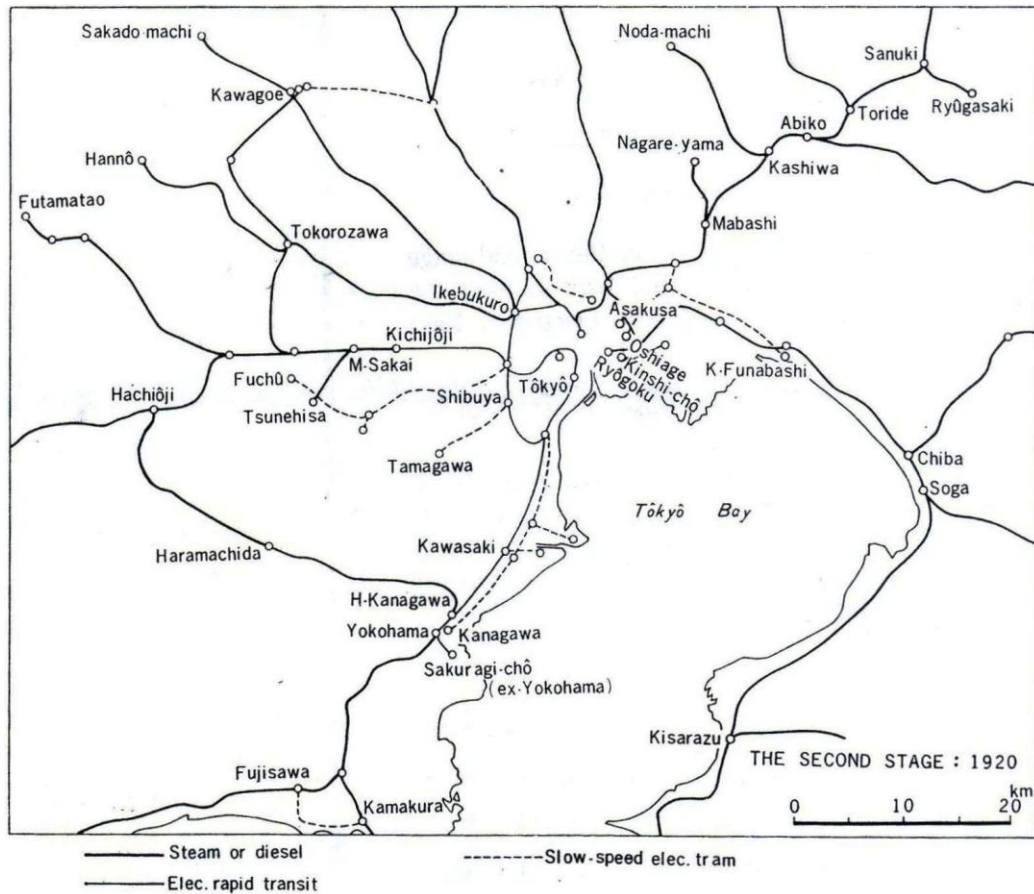
cut freight tariffs and passenger fares, and standardize and integrate railway infrastructure” (Aoki et al., 2000, p. 40). It had the added goals of making it possible to issue foreign bonds that could be mortgaged against railway assets and of preventing foreigners from holding shares in the railways (Aoki et al., 2000). Just prior to nationalization, private railways had represented 68% of all rail trackage in the country²⁷ (Ibid), so this had a severe impact on the private railway operators, who under the law could only build railway lines that weren’t in competition with government lines (Shoji, 2001).

(Private railway operators) were thus compelled to serve areas with small populations. While private companies anticipated that rail operations could be self-supporting, the limited customer base forced them to ‘generate’ ridership through business diversification (Ibid, p.15).

What might have been a death blow to the private railways turned out to be a blessing in disguise. Because they were forced to diversify into other areas, particularly real estate, operators weren’t wholly dependent on fares for revenue. The private railways were able to survive and thrive by branching out into businesses closely connected with the railway industry, while private operators in Europe and North America slowly began to fail due to increased competition from the automobile. Unlike the bankruptcies that hit railway operators in most other countries, many of the original private railway companies are some of the biggest players in the Japanese railway industry today (Shoji, 2001).

²⁷ Private railways totalled 5,213 km while government railways covered 2,413 km (Aoki et al., 2000).

Figure 3: The Tokyo railway network in 1920



Source: Arisue & Aoki, 1970, p. 193

The two decades between 1915 and 1935 saw a huge expansion in railway lines, with 580 km of track built (Cervero, 1998). Residential growth was fuelled by the development of rapid rail transit by the private railways on the western side of Tokyo in the 1920s and early 1930s (See Appendix B for a list of new railways of the period), causing traffic to concentrate at the terminal stations on the Yamanote line, especially Shibuya, Shinjuku, and Ikebukuro stations (Fig. 3). This was the start of their new role as sub-centres of the original Nihombashi business district, forming a polycentric city structure that now makes up Tokyo. Two of the railway operators, the Meguro-Kamata (or “*Mekama*”) and Tokyo-

Yokohama (or “*Toyoko*”) railways, were also real estate developers (Arisue & Aoki, 1970, p. 198) that eventually merged to form Tokyu Corporation, whose history is dealt with in Section 5.5.2.

Since the national government had nationalized mainly the intercity trunk lines with the heaviest ridership, private railway companies in Osaka and Tokyo began diversifying into other business areas related to urban living in order to stimulate ridership on the remaining relatively unpopulated lines. Starting with the development and sale of residential land along their train lines, they then began constructing and operating department stores at terminal stations as well as putting in tourist attractions along the route. Some companies began selling electricity to households and businesses, making large profits until the national government took them over at the start of World War II (Aoki, 1996, in Cervero, 1998).

The widely acknowledged pioneer in this diversification strategy was Ichizo Kobayashi, the president of Hanshin Electric Railway in Osaka. Beginning with the sale of residential land prior to laying its first railway in 1905, Hanshin began running zoos, sports arenas, and the Takarazuka theatre company (Kato, 1996). Hanshin also began putting shops into station buildings; it first added a small restaurant to its main station in Osaka, and then started including different types of stores and shops whenever station buildings were expanded. The success of these businesses led them in 1929 to open the first department store in Japan owned by a railway company, the Hankyu Department Store (Ibid). In contrast to other major Japanese department stores that aimed for the upscale

market, Hankyu and other department stores owned by the private railways targeted the mass market, to great success.

The first subways appeared in Tokyo in 1927, and by 1929 there were two subway companies with a total of 14.3 km of track (Arisue & Aoki, 1970). Additional subway development didn't take place until well after World War II, when the Teito Rapid Transit Authority (*Teito Kosokudo Kotsu Eidan*) and the municipal authority expanded the system in the run-up to the 1964 Tokyo Olympics (Ibid). In August of that year, subways signed reciprocal agreements to allow through operations with other rail lines. Instead of suburban trains ending at terminal stations surrounding the central city, the trains now ran directly onto the inner city subway tracks, and vice versa, saving transfer time and reducing congestion. Today, seven subway lines provide through operations, with a total route length of 380 km (Yajima, 2000).

5.2 The private railways today

Tokyo's metropolitan rail network is the largest in the world (Cervero, 1998). Of the 2,000 km of rail lines in Tokyo Metropolis, 52% were built by the private railway conglomerates (Ibid). There are 88 private railways²⁸ offering passenger service in Japan, with 16 major companies that operate in Tokyo, Osaka, and Nagoya (Shoji, 2001). Even with the growing popularity of the automobile and air travel, Japan's private railways continue to increase ridership. Between 1975 and 2003 ridership increased by 124%, while during the same

²⁸ The seven companies in the Japan Railways Group are not included with the other private railways, even though they are now for-profit companies.

period automobile passengers jumped by 232% and aircraft passengers 368% (Masumoto & Kosuda, 2005). Private railways carried 13.85 billion passengers in Japan in 2007, a 2.9% increase over 2006 (Ministry of Land, Infrastructure, and Transport, 2008a).

The last public railway operating in Tokyo was Japanese National Railways, which was privatized and broken up into seven companies in 1987. The Japan Railways Group companies carried 9 billion passengers in 2007, a 2.4% increase over the previous year (Ministry of Land, Infrastructure, and Transport, 2008a). JR East, one of the seven Japan Rail companies created in the privatization, is still the largest rail operator in Tokyo Metropolis²⁹ (JR East, 2004). It owns two thirds of the rail network in the TMA, with the remaining third divided between nine private railways³⁰. And while there are public corporations that operate rapid transit in the city, including Tokyo Metro (*Tokyo Chikatetsu Kabushiki-gaisha*), they are financially independent from both local and national governments (Ieda, 2000).

The private railways tend to run operations through four divisions: railways, transportation, real estate, and other businesses (Shoji, 2001). The rail divisions generally run commuter trains, but companies will also operate trains to airports and resorts, intercity trains, and also freight services. The transportation divisions oversee services like buses and taxi links to railway lines, sightseeing buses, and intercity express buses (Ibid). The real estate divisions develop commercial and residential properties, often along company railway lines, and

²⁹ Not only is JR East the largest passenger railway in Japan, it is the largest in the world, carrying over 16 million passengers every day (JR East, 2004).

³⁰ Keikyu, Keio, Keisei, Odakyu, Seibu, Sotetsu, Tobu, Tokyu, and Tokyo Metro

also lease them. Other business divisions can operate retail stores, restaurants, stadiums, sports teams, golf courses, and amusement parks³¹. Not only do private railways generate revenue from sources other than fares, but for four out of the nine private railways studied by Yajima (2000) in 1996, non-operating revenue exceeded fare revenue. Rail and bus operations only produce small profits, while the "...windfalls come from the land appreciation induced by the railway investments" (Cervero, 1998).

The group members are connected through cross-shareholding and other financial links, interlocking directorates, long-term business relationships and other social and historical links (Shoji, 2001). Although many group companies are quite independent with weak ties to the other group companies, "...the sum of the group covers the entire 'food chain' and offers a full range of lifestyle services" (Shoji, 2001, p. 15).

5.3 Private railways and the national government

5.3.1 Regulation

The private railway industry in Japan is tightly regulated by the Ministry of Transportation. Requests to increase fares are submitted every two years in a joint application by all the private railways, based on an estimate of future income and expenditures (Jones, 1983). The major private railways in large cities "...use a rate-base calculation system in which capital costs are determined systematically using an asset scale for railway services" (Terada, 1994). Smaller

³¹ For example, Keisei Corporation was a co-developer of Tokyo Disneyland (Cervero, 1998).

private railways meanwhile use a cost-plus system, whereby fares are calculated to cover incurred costs, including capital costs (Ibid). The national government has had a policy of limiting fare increases to suppress inflation, which has had the effect of discouraging private railways from investing large sums in railway operations, except for remodelling facilities to run longer trains (Shoji, 2001).

5.3.2 Assistance

The traditional policy of the Japanese government has been to subsidize only the construction of new rail lines and stations by private railways, and not to provide operational subsidies (Yajima, 2000; Mizutani, 1994; Ieda, 2000). The first such subsidies were offered under the “Light Rail Subsidy Law”, introduced in 1911 (Hayashi, 1989). It offered funding to new private railway companies limited to 5% of construction costs for the first five years³² after their establishment (Ibid). Tokyu Corporation was later one of the beneficiaries of these subsidies during the six years it took the company to reach profitability. Nowadays, assistance towards the capital costs of new rail extensions is provided to railways in the major metropolises, but the amounts are small compared to the amounts given to the public subways (Mizutani, 1994). Asano (1998, p. 257) notes that “...the basic principle for construction and operation of public transportation in Japan has long been ‘self-finance’...”. As far back as 1989, private railways received only 5% of total subsidies available, while carrying 79% of passenger-km in urban centres (Ibid). Aoki et al. (2000) believe

³² Extended to 10 years in 1914.

that the government has determined that the private railways are already sufficiently cross-subsidized from non-railway profits.

Ieda (2000) found that although Japanese private railways receive little help with construction and operating costs, financial assistance is available for paying off interest on large scale investments. And although the 16 major railway companies are self-sufficient, some smaller operators in less populated areas of Japan do receive funding. They are eligible for operational subsidies and capital subsidies on "...lightly used but socially important lines..." (Mizutani, 1994, p. 188). However, the amounts are very small, with three billion yen (\$30 million USD or €22.5 million Euro) given to small and medium railways in 1995, which was only 1.6% of their total revenue (Shoji, 2001).

Government assistance for private railways is mainly for the purpose of infrastructure improvements that benefit the public, but would not be a top priority for the companies themselves. The 'Heartful Building Law'³³, introduced in 1994, along with the Barrier-Free Transportation Law of 2000, aim to increase accessibility in a country where the proportion of those over 65 is expected to pass 30% by 2025 (Sekiguchi, 2006). This includes funding for construction of physical facilities and vehicles for handicapped passengers as well as adding elevators and escalators to existing stations. Funding is also available for commuter rail projects such as quadruple tracking that reduce average load factor³⁴ during peak hours (Ieda, 2000).

³³ The formal name is the more prosaic 'Law promoting the construction of easily accessible buildings' (Sekiguchi, 2006).

³⁴ Average load factor in transit systems is the total number of riders to the theoretical capacity. In Japan, 100% capacity means that each seat and overhead strap is utilized.

While private railways receive very little government funding, subsidies are given to transportation systems that feature specialized technologies and unique track systems, such as monorails and Automated Guideway Transit (AGT) systems (Shoji, 2001). Private railways are not even eligible for these subsidies. Subways are also viewed favourably by the national government, which pays 70% of the construction costs of eligible infrastructure through the Subway Construction Cost Subsidization Program (Ibid). However, these types of programs have generated much criticism in Japan in recent years.

5.3.3 Profitability

What is remarkable is that even in the absence of most government funding, all companies were able show a gross profit in 1996 (Fig. 4), with an operating ratio³⁵ greater than 1.0. In North America and Europe, by contrast, transit authorities with operating ratios of more than 100% were already rare by the early 1970s, making up only eight out of 34 transit authorities in a 1971 survey (Shoji, 2001). By 1977, none had over 100%, and 42 out of 43 surveyed had ratios below 80% (Ibid).

³⁵ Vuchic (2005, p. 313) defines operating ratio as "...the ratio of revenue from transit fares and other revenues to the costs of operating the service." Transit agency revenues are usually grouped into farebox revenue (includes weekly and monthly pass sales, employer contributions to employee transit passes), other income (charters, advertising, etc.), and financial operating assistance from the government (Ibid). Operating costs are broken down into wages, fuel and power expenses, maintenance and repairs, fare collection expenses, advertising and marketing, vehicle licensing and registration, insurance, and general and administrative expenses (Ibid).

Figure 4: Financial position of the nine private railways

		Operating Length (km)	Passenger km (million)	Fare rate (USD/person/km)	Operating ratio
Private Operators	Tokyu	100.1	8,739	0.104	1.08
	Tobu	463.3	14,374	0.081	1.07
	Seibu	173.8	9,411	0.073	1.06
	Odakyu	120.5	10,874	0.075	1.08
	Tokyo monorail	17.8	725	0.175	1.02
Public Operators	TRTA	183.2	15881	0.137	1.01
	TMS	68	3870	0.162	0.81
Third sector	Hokuso Kaihatsu	32.3	341	0.208	0.73
	Chiba monorail	15.2	69	0.359	0.8

Source: Yajima, 2000, p.628

In Canada the average operating ratio was 58% in 2007 (CUTA, 2008).³⁶ Moreover, operating revenues do not cover any capital expenditures, which in Canada are financed almost completely by the three levels of government³⁷ (Ibid). In Japan, by contrast, “The fundamental guiding principle of private railways is that total operating costs should be covered only by revenue received from fares” (Jones, 1983, p. 54).

Mizutani (1994) determined that the profitability of Japanese private railways is partly due to the accounting rules of the Japanese railway industry.

³⁶ This partly reflects the size of the population being served; the average operating ratio was 61% in communities of over 400,000 people, 47% for communities between 400,000 and 150,001 people; 39% for communities between 150,000 and 50,000 people but only 33% in communities under 50,000 people (CUTA, 2008).

³⁷ In 2007, the federal contribution was 29%, provincial 49%, and municipal 19%, with the remaining 3% coming from other sources

For example, depreciation is calculated using the historic cost rather than the replacement cost of capital equipment, which helps profitability since it undervalues the private railways (Ibid). But he found that many public railways in other countries also conduct their accounts in this way, or in the case of the U.S., don't include depreciation at all (Ibid). He concluded that even if replacement cost of capital were used, Japan's private railways still receive much less in the way of subsidies that other industrialized countries (Ibid).

While some researchers point to the extremely high passenger volumes as the reason for the success of Japanese private railways, Shoji (2001) points out that density alone does not guarantee their success. As well, "The provision of capacity necessary to cover rush hours creates huge overcapacity during off-peak periods" (Ibid, p. 15). Another point is that profitable private railways are not limited to Japan's largest cities. Even outside of major metropolitan areas, 29 out of 63 companies studied by Shoji (2001) had profitable rail operations, increasing to 34 out of 63 when diversified operations were included. Even density did not seem to be especially vital for their profitability, as long as the passenger-km density³⁸ was above 2,000 (Ibid).

5.4 Reasons for success

5.4.1 Diversification

Following the early examples of Hanshin in Osaka and Tokyu in Tokyo, Japanese private railways have diversified into a wide range of businesses that depend on the accessibility created by the railway, while being almost completely

³⁸ Passenger-km density is calculated by dividing passenger kilometres by route kilometres.

independent of the private railway sector (Jones, 1983, p. 61). Property development is the most profitable business for many of the conglomerates and has "...increased the liquidity and creditworthiness of rail companies to the point that loans they need to finance rail expansion are usually available at very favourable terms (and often from the consortia themselves, if necessary)" (Cervero, 1998). And as mentioned, private railways have also benefited from the increases in land value that come from increasing accessibility of properties near stations. The railways can use these funds to retire capital bonds for rail investments (Ibid), while the sale of the land for residential development means that more people will be living near stations, thereby increasing ridership over the long run.

Other important businesses include leisure and sports, engineering and construction, retailing, hotels, travel agencies, trucking and ferries, and buses and taxis (Ibid).

Diversification has other benefits for the private railways (Shoji, 2001):

- Other group businesses help to increase ridership
- The group companies can sell to their passenger base
- With their experience in non-rail businesses, the railways have developed a more market-oriented approach to its passengers
- Operating costs of the railways can be lowered by sharing costs and group members between the rail and diversified divisions
- Operating costs are reduced with more effective use of group managerial resources

There is also the advantage of cross subsidization from ancillary businesses. Large conglomerates like Tokyu Corporation are able to use intra-firm cross subsidies to subsidize unprofitable lines with revenues from profitable lines (Ieda, 2000), invest in new infrastructure, and cover operating costs. With large amounts of cash being generated from railway operations every day, the conglomerate takes on the role of a bank, distributing funds to related companies (Masumoto & Kosuda, 2005). Private railways have to be careful, though. While they are permitted to operate non-rail businesses, the rail and non-rail sides are strictly separated³⁹ by the Railway Accounting Ordinance (Shoji, 2001).

While it is very difficult to determine quantitatively how much cross subsidization takes place, when Jones (1983) surveyed companies in Osaka about the practice, he found that most companies practiced some form of cross subsidization. Examples included Nankai Electric Railway receiving subsidies from its real estate companies and department stores as well as Hanshin Electric Railway receiving some rent through its real estate department from department stores built on railway land (Ibid). This sort of subsidy can act as a shock absorber to smooth revenue flows, especially in times of high investment in new railway infrastructure.

³⁹ Cervero (1998) states that, technically speaking, businesses are not cross-subsidized, as construction and operating costs are paid for by fare revenue. Under the Railway Accounting Ordinance, property development income can't be used to cover construction or operating costs, in order to prevent excessive fare increases that might take place if the accounts of rail and real estate businesses were mixed.

5.4.2 Employee productivity

Mizutani (1994) studied why Japanese private railways can operate largely without subsidies, comparing fares between public (mainly subways) and private urban railways in Tokyo. He determined that fares were on average about 24% higher on public railways, adjusting for differences in load factor and trip length. He also found that the labour productivity of private railways was 31-32% higher than public railways when controlling service output level, network factor, and contracting-out by regression analysis. Station employees of private railways were 51% more productive, and maintenance employees were 17% more productive in track maintenance and 50% more productive in car maintenance. Mizutani determined that productivity per maintenance employee for private railways was higher due to the practice of contracting out, which was used more by private railways. Even when looking at train operators and conductors, private railways were 18% more productive. Operating costs per passenger-km for the public urban railways were also 83% higher than for private railways, as public railway labour was 31% less productive while employees earned 16% higher wages than those in the private sector.

5.4.3 Innovative management

One early innovation of the private railways was to allow reciprocal through operations with subway systems in the centre of Tokyo. Rather than having customers transfer once they reach the Yamanote loop line, trains now directly connect with suburban rail lines. The Den-en Toshi line, for example, turns into the Hanzomon line after arriving at Shibuya station. Tokyu motormen

not only operate Tokyu trains along the subway lines, but also are able to drive the subways along Tokyu lines.

Newer and more efficient technology is continually being introduced by the private railways to make it easier for customers to access stations and purchase tickets. Automatic ticket gates were an early innovation that also reduced personnel costs. The rechargeable PASMO smart card has recently been introduced on private railways and buses in Tokyo, and it can also be used on JR lines (Tokyu, 2007). Fares are calculated automatically, and cards can be recharged online.

Private railways are also very interested in customers' needs. Tokyu's station employees are periodically visited by a 'secret shopper', who evaluates their responses to customer complaints and requests for help (Tokyu Corporation, 2008). Keio Electric railway began offering women-only cars in March of 2001 in response to complaints about women being groped by men on crowded railway cars (Pravda, 2006). Since then, all private railways in Tokyo have followed suit (Ibid).

5.4.4 Low fares

As mentioned earlier, rail and bus fares are regulated by the Ministry of Transportation and kept at affordable levels (Cervero, 1998), with fare increases occurring every two years (Jones, 1983). While Tokyu Corporation could try to press for higher increases, it is definitely not in their best interests to upset passengers when most of their profits come from businesses like real estate, retail, and other ancillary businesses that are frequented by these same

passengers. The fact that the company has a long-term interest in maintaining the goodwill of those who use its train lines means that it naturally does not try to profit excessively from its railway operations.

5.4.5 Ability to compete with Japan Railways

While Japanese National Railways (JR) enhanced its reputation with the development of the Shinkansen in the 1960s, the development costs as well as inefficiencies in the rail network led to massive debts by the mid-1970s (Jones, 1983). By 1984, a JR train journey between Kobe and Kyoto cost twice as much as on the Hankyu private railway. While up to and including the late 1960s private railways had stopped being taken seriously by the central government, beginning around 1980 officials at the Ministry of Transportation became openly enthusiastic about the success of the private railways in comparison to public railways (Ibid), leading to the eventual privatization of JR in 1987.

5.4.6 National government policies that generally favour public rather than private transportation

Tax incentives are one way that the government encourages ridership on public transit. All workers in Japan receive a tax-free commuting allowance as high up to 100,000 yen (\$1,000 USD or €750 Euro) per month from their employers (Yamaga, 2000). This contrasts with automobile commuters, who only receive 15% of this amount based on distance travelled (Cervero, 1998). As well, a portion of expressway tolls and automobile taxes go directly to public transit demonstration projects and to subsidize the building of underpasses and overpasses by private railways (Jones, 1983).

5.4.7 Exclusive franchises

“In greater Tokyo private rail companies have been granted exclusive franchises for specific territories over the years. This has eliminated direct competition and enhanced profitability” (Cervero, 1998). Buses are also run mainly by the transportation division of a railway conglomerate, such as Tokyu Bus serving stations on Tokyu rail lines.

5.4.8 Japanese management style

The system of guaranteed lifetime employment and seniority by age ensures staff loyalty and also allows corporate identity to perpetuate. Jones (1983) notes that the long-term retention of key management, with their cumulative knowledge of railway planning and the organization itself, provides strength to the companies. The 16 largest private railways have an in-house trade union called the Association of Japanese Private Railways (Nihon Min'ei tetsudo kyokai) that negotiates with management twice a year, once in the spring for improved wages, and once in the fall for improved working conditions. Bargaining is by consensus, and Jones notes a “...cooperative spirit with respective managements and a competitive attitude to other companies...” (1983, p. 22).

5.5 Tokyu Corporation and its developments

5.5.1 A major force in the private railway industry

Tokyu Corporation is one of the 16 major private railway operators in Japan and one of the first companies to create master planned developments

around its train stations. It was established as a regional development company in 1922 and has since grown to become Japan's largest rail-based conglomerate with a total of 390 companies and 9 foundations (Cervero, 1998), employing about 30,000 people, of which 3,400 work directly for the railway (Tokyu Corporation, 2007). While the real estate, retail, and tourism businesses seek to bring passengers into stations, "...activities such as construction, design, and engineering have sought to capitalize on and expand the domain of the railroad companies' labour forces" (Cervero, 1998, p. 190).

Tokyu has seven main lines and one small branch line (Fig. 5) and its rail network is mostly free from competition from other lines, except for several JR East lines that cross Tokyu rail lines from north to south. Because the rail lines are relatively short, the rail trips are also short, which has produced the highest ridership and farebox returns per km of track of all the private railways (Cervero, 1998).

Figure 5: Tokyu railway route network



The Toyoko line (red) connects Yokohama station in the bottom left with Shibuya station in the upper right. Den-en Toshi line (green) and Toyoko line (red) converge at Shibuya station. Source: Tokyu Corporation, 2007a

Although in size it is only the 13th largest railway network in Japan, it carries the most passengers of any of the private railways⁴⁰ (Ibid). In 2006, its 2.79 million riders *per day* gave it the highest average daily ridership of any of the suburban railway companies, bested only by the Tokyo Metro and JR East (Ministry of Land, Infrastructure, Transport, and Tourism, 2005; Tokyu Corporation, 2007). Ridership was 1.02 billion passengers in 2006 (AJPR, 2007).

Tokyu is one of the most profitable railway operators in the country, with operating revenues of 263.7 billion yen (\$2.63 billion USD or €1.98 billion Euro) and net profits of 58.72 billion yen (\$587 million USD or €441 million Euro) in

⁴⁰ The top five Japanese private railways by yearly ridership in 2006: Tokyu, Tobu (855 million riders), Odakyu (689 million riders), Hankyu (618 million riders), and Keio (613 million riders) (Tokyu Corporation, 2007).

2006 (Tokyu Corporation, 2007). Transportation (rail and bus) accounts for 13.8% of Tokyu corporation's revenues and real estate accounts for 9.3%, with retail having the largest share at 47.6% (Tokyu Corporation, 2007). When looking at net profits, however, real estate and transportation each make up 33.5% of net profits, while retail brings in 20.2%.

5.5.2 From real estate developer to diversified conglomerate

Tokyu Corporation began life as Meguro-Kamata Dentetsu, the railway division of the Den-en Toshi (Garden City) Corporation, a development and real estate company (Oshima, 1996). The corporation had been founded by developer Eiichi Shibusawa, publishing magnate Tsuneta Yano, and a group of influential businessmen to build Den-en Chofu. The first Garden City in Japan, Den-en Chofu was built between 1922 and 1926 on the Garden City model of Ebenezer Howard (Miyata, 1995). The Den-en Toshi Corporation bought large tracts of land for development prior to laying the rail lines (Cervero, 1998), in a location 30 minutes to the west of Tokyo.

Sales were very slow initially, but the company had an unlikely saviour in the Great Kanto Earthquake of 1923 (Tokyojin, 1997). With the central city burned out, the suburbs suddenly became very appealing, and Den-en Chofu quickly became one of the most prestigious residential areas in Japan (Cervero, 1998). Meguro-Kamata Dentetsu, led by president Keito Goto, took over the Den-en Toshi Corporation as well as a number of other railways, continuing to build numerous rail integrated communities throughout the 1930s (Ibid).

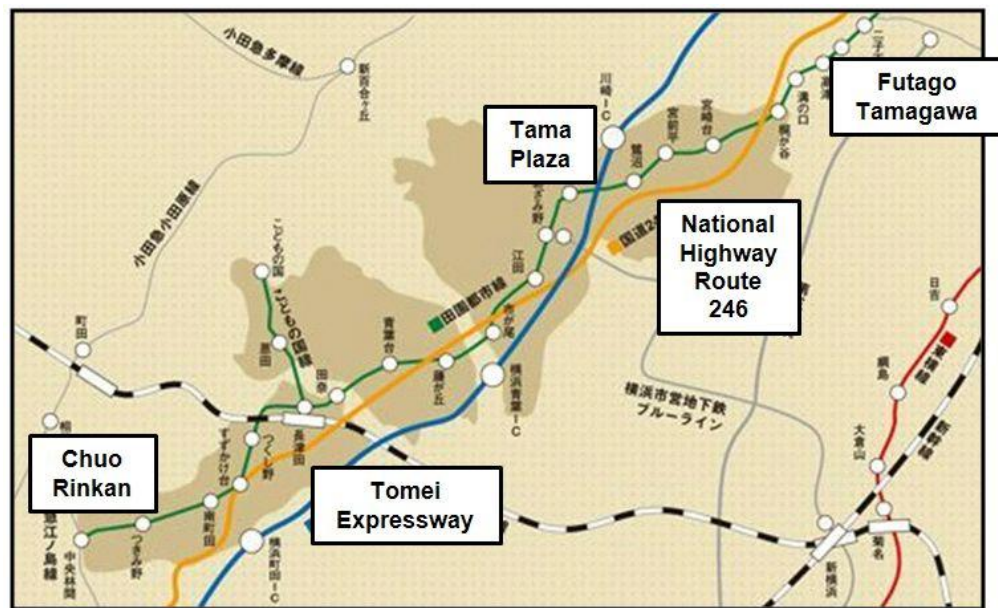
Tokyu Corporation adopted its diversification strategy from Ichizo Kobayashi, the president of Hanshin Electric Railway. In fact, President Keito Goto "...learned directly from Kobayashi about (his) management methods and implemented them in his own company's diversification" (Kato, 1996, p.5). Goto's own innovation was to attract universities and other educational institutions from the urban centre to suburban locations near its stations (Ibid). On the Toyoko line, for example, Tokyu built high rise commercial centres at Shibuya station in Tokyo at one end and Sakuragicho station in Yokohama at the other, opening its first department store near Shibuya in 1934 (Cervero, 1998). It offered land at low rates to universities and schools in order for them to build campuses at intermediate stations along the way. The commercial hubs and the universities "...have produced a steady bidirectional flow of passengers, ensuring efficient train operations" (Cervero, 1998). While Tokyu was one of the earliest adopters of a diversified strategy, most private railway operators embraced it only after World War II (Kato, 1996). During the postwar boom in residential land development, Tokyu was well positioned to take an even larger role in development (Ibid).

5.5.3 Tama Den-en Toshi: City building

Between 1960 and 1984, Tokyu Corporation built the largest land development ever created by a private railway (Bernick & Cervero, 1998) on 5,000 hectares of farmland in the Tama area of Tokyo (Fig. 6), at a distance of 15 to 35 km west of the 23 wards (Tokyu Corporation, 2007b). Tama Den-en Toshi was conceived as a string of small towns connected by the Den-en Toshi

line, which was built in stages between 1966 and 1984. The line was half financed with commercial loans and half with loans from the Japan Development Bank (Cervero, 1996). While the pre-development population of the area was only 30,000 people when the project was conceived in 1955, rapid development quadrupled the population to 120,000 by 1971 (Keiei Jōhō Centre, 1971), and further increasing to 440,000 by 1988 (Kawasaki, 1993). By 2007, Tokyu had created a community of 580,000 (Tokyu Corporation, 2007b).

Figure 6: Map of Tama Den-en Toshi



Tama Den-en Toshi development is represented by the darker shaded area. The green line is a portion of the Tokyu Den-en Toshi line, stretching from Chuo Rinkan station in the southwest to Futago Tamagawa station in the northwest. The blue line is the Tomei Expressway. The orange line is National Highway Route 246. Source: Tokyu Corporation, 2007

Tokyu Corporation used a process called land readjustment to assemble the land and finance the infrastructure for Tama Den-en Toshi (Cervero, 1998). Originating in Germany in the 19th century, but nowadays used

in countries as diverse as Australia, Korea, Taiwan, and India (United Nations, 1994), land readjustment "...is considered to be the 'mother of town planning' in Japan, and as such has formed the backbone of urban planning and development in metropolitan areas, particularly in managing suburban expansion" (Simian, 1989, p. 13). About 30% of urban land in Japan has been developed through this method (United Nations, 1994). Land readjustment falls under the jurisdiction of the Ministry of Construction, which makes it a very influential organization in city planning (Simian, 1989). The ability to use land readjustment in Japan "...has relieved railway companies of the tremendous upfront burden and cost of acquiring land and funding infrastructure" (Cervero, 1998, p. 194).

Under this approach, private landowners form an association of all owners and lessees of land in the project area (Sorensen, 1999). Before the association can be incorporated, agreement of at least two-thirds of the owners and lessees is necessary (Ibid). The properties of the participating private landowners are replotted, minus a contribution to a land pool⁴¹ (Simian, 1989). This land is used to improve the road network, to create amenities like parks and schools, and also to assemble reserve land that will be sold off to pay for the costs of roads, sewers, and other infrastructure and provide landowners with a profit (Keiei Jōhō Centre, 1971). The newly replotted lots are located as near as possible to the original land (Simian, 1989). While the private landowners receive smaller

⁴¹ Landowners in the Tama Den-en Toshi area gave up 45% of their land in exchange for a fully serviced plot (Cervero, 1998).

parcels of land in the end, they receive in return a fully serviced parcel (Cervero, 1998) which has greatly increased in value (Keiei Jōhō Centre, 1971).

For Tama Den-en Toshi, 54 associations were formed between 1953 and 1966, through which Tokyu was able to consolidate almost 5,000 hectares of land for development (Cervero, 1998). The original landowners were mostly farmers who trusted that Tokyu could create high quality rail integrated communities, based on their successful background in building garden cities (ibid). The associations "...relinquished development rights and full control over project planning to Tokyu" (Cervero, 1998, p.210). Half of the pool of land was kept in reserve to pay for development costs, while the other half was put into public use⁴² for parks, museums, tennis courts, and swimming pools⁴³ (Keiei Jōhō Centre, 1971). The sale price of reserve land almost quadrupled between 1953 and the mid-1960s, jumping from \$0.43 per m² to \$1.50 per m² (Cervero, 1998).

Tokyu encouraged development by selling land to public housing corporations, private homes⁴⁴, and for corporate housing (Cervero, 1998). The sale of this land in turn was used to pay for infrastructure. Many of the homes were built and sold freehold by the Tokyu Real Estate Company, garnering

⁴² As an example of land use in Tama Den-en Toshi, Block 1 (the first block developed) totalled 118 hectares, with 71% devoted to residential area, 19% to roads, 3% to parks, 5% to schools, and 2% to the station and plaza area (Keiei Jōhō Centre, 1971).

⁴³ By 1971, there were already 10 kindergartens, 10 elementary and secondary schools, 5 post offices, 6 police stations, 2 fire stations, 70 medical facilities, 570 commercial facilities, 8 leisure facilities, 5 driving ranges, and 3 bowling alleys (Keiei Jōhō Centre, 1971).

⁴⁴ Nine factors determined the pricing of lots in Tama Den-en Toshi: 1) Commute time, 2) Convenience of public transit (transfer, congestion), 3) Natural features, 4) Status of neighbouring residents, 5) Educational and public facilities, 6) Land use constraints, 7) Estimated time to develop land, 8) Name recognition, 9) Other (Degree of promotion, overall cost) (Keiei Jōhō Centre, 1971).

premium prices due to Tokyu Corporation's investment in neighbourhood amenities like museums, sports facilities, and tennis courts (Cervero, 1998). Tokyu also donated or sold land cheaply to universities, private schools, government offices and facilities, diversifying land use and attracting off-peak and reverse direction riders (Ibid). Due to this mixing of land uses, ridership actually grew more quickly than the population of the area (Keiei Jōhō Centre, 1971).

The next section will look more in depth at Tama Plaza station, part of the Tama Den-en Toshi development, through a series of 10 indicators for rail integrated communities. Jiyugaoka, another station area developed by Tokyu in the late 1920s, will also be examined.

6. RIC INDICATORS FOR JIYUGAOKA AND TAMA PLAZA STATIONS

Rail integrated communities (RICs) function are used quite differently from transit oriented developments (TODs). Particularly for those in North America living in low density, suburban areas of single family homes that are accessible only by automobile, it may be difficult to imagine how RICs look, feel, and function. By surveying two station areas in detail through a series of indicators, I hope to bring these communities to life and allow them to be compared empirically with TODs in North America. The RICs created in Tokyo in the past 100 years have never experienced significant drops in ridership, nor have their rail systems been abandoned like in most of North America's original streetcar suburbs. The continuous process of refinement of the RIC concept in major Japanese cities by private railways means that insights should be gained from analyzing long-standing RICs that cannot be gained from analyzing newly created ones.

6.1 Selection of existing TOD indicators

Studies of TODs in the past have tended to focus exclusively on ridership numbers and land value changes that occur once TODs are created. However, "...little empirical research has been conducted to holistically measure the outcome of TOD" (TRB, 2005, p.1). By rating TODs on an integrated set of indicators, they can be systematically measured, evaluated, and monitored (Ibid,

p.2) to determine their success and can also be compared with TODs in other countries.

Ten indicators are being used for this analysis, six of which are adapted from the list of *Suggestions for Evaluating TODs*, prescribed in a report entitled *Transit-Oriented Development: Developing a Strategy to Measure Success* (TRB, 2005) published by the Transportation Research Board's National Highway Cooperative Research Program. The report found 56 existing indicators for TODs in the United States, which they divided into five groups: travel behaviour, economic, environmental, built environment, and social diversity/quality. A survey was then conducted of transportation professionals to determine the usefulness of each indicator, the difficulty in obtaining the data to create the indicator, and the frequency with which it should be collected.

This narrowed the list down to nine items: *transit ridership counts, number of mode connections at the transit station, number of parking spaces, density (housing density and population density), increase in property value and tax revenue, quantity of mixed-use structures, quality of streetscape design (pedestrian orientation / human scale), pedestrian activity and safety, and public perception*. These indicators are identical to the TOD indicators developed by the Planning and Transport Research Centre in Western Australia, except a public perception indicator was not used (Government of Western Australia, 2006).

In a survey of professionals working with TODs at government offices, planning agencies, and transit agencies, the TRB (2005) found that the most useful indicators were the qualitative rating of streetscape, pedestrian counts, and level of transit ridership. TRB concluded that "...a transit station with a poor urban fabric and few pedestrians, but lots of commuter parking and high levels of transit ridership, would not rate highly as a successful TOD" (TRB, 2005, p. 19). Six of the nine indicators used by both the TRB and the Planning and Transport Research Centre will be used in this analysis: ***Transit Ridership, number of mode connections, number of parking spaces, density (housing density and population density), quality of streetscape design, and pedestrian safety.***

The indicator *increases in property value and tax revenue* is used for examining new TODs, but since the two stations in the case study are not new developments, ***property values within and beyond 500 metres of the station*** have been compared instead. The indicator *public perception* will not be included, as it looks at the percentage in favour of new TODs, which isn't a useful indicator for long-established Tokyo RICs. Finally,

Ten indicators for rail integrated communities

- 1) Transit Ridership (boardings, alightings, and through passengers)
- 2) Quality of service (frequency, hours of service, passenger load, and commuter pass cost)
- 3) Transit rides per capita and mode share (primary means of transportation & between home and train station)
- 4) Number of mode connections
- 5) Number of parking spaces (bicycle and automobile)
- 6) Density (housing density and population density)
- 7) Property values within and beyond 500m of the station
- 8) Quality of streetscape design
- 9) Pedestrian safety (per capita death rate)
- 10) Crime rate (per 1,000 people)

the Japanese government doesn't keep data on the *quantity of mixed-use structures*.

6.2 Adaptation and addition of indicators for RICs

While six of the TOD indicators could be also used with RICs, some had to be adapted to reflect local conditions. As mentioned, **property values** surrounding the station will be compared rather than *increases* in property values. Although 'number of parking spaces' in the TRB and Government of Western Australia reports refers exclusively to *automobile* parking, I have added counts for bicycle parking since more commuters cycle to train stations in Tokyo than drive (Ministry of Land, Infrastructure, Transport, and Tourism, 2005a). Finally, as data was available on the number of through passengers at each station, this was added to the **transit ridership** indicator, to supplement data on boardings and alightings.

As well, four additional indicators were added to capture empirically some of the unique characteristics of RICs. In order to include a performance measure of transit that reflects the passenger's point of view (as opposed to vehicle-focused performance measures), as well as demonstrate the high quality of rail service in Tokyo, a **quality of service** indicator based on the Quality of Service Framework created by the Transportation Research Board will be used (TRB, 2003). This indicator divides quality of service measures into two categories that "...address the spatial and temporal availability of transit service" (Ibid, p. 3.2). The categories are availability (*frequency, hours of service*) and comfort and

convenience (*passenger load*). **Commuter pass cost** has also been added as a service measure to facilitate cost comparisons with other transit systems.

Transit rides per capita and **mode share** have been added, as data for Tokyo is readily available, and the Transportation Research Board also recommends indicators to help quantify "...not only localized outcomes (of TODs) but also regional impacts on traffic congestion and air quality..."(TRB, 2005). Finally, I have added the indicator **crime rate** within the ward where the station is located, as safety concerns are one of the most important reasons why passengers in North America don't ride transit, especially in large cities (Hartgen et al, 1993).

These indicators will be used as a starting point for assessing and comparing RICs, in order to see how they function and how they benefit the public. It is vital to provide indicators in order to help describe RICs to people who have never seen or experienced them. As well, indicators can help governments and transit agencies justify the development of more of these types of communities around rail stations. Indicators can also be one tool that can be used to measure progress towards the goals of smart growth through the development of more sustainable communities.

6.3 Limitations of RIC indicators

The indicators should not be used to judge the success of one RIC versus another, since every station is different and expectations for each may vary greatly, especially between countries. As well, the definition of success can vary widely; the stations that I have defined as successful RICs may not be successful

from the standpoint of others. As an example, high property values may be advantageous for land owners, but negative for those with limited incomes who cannot afford such developments.

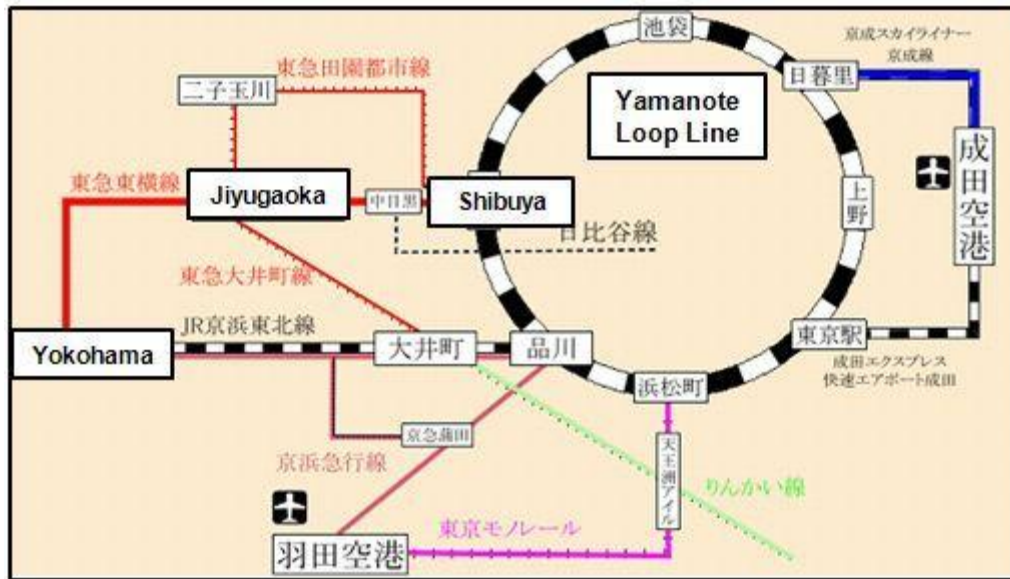
Other indicators could also be added to round out the picture, such as the rate of automobile ownership, the land use mix, vehicle kilometres travelled, or gasoline consumption. Moreover, since both Jiyugaoka and Tama Plaza have histories going back over 40 years, newly developed RICs should not be expected to meet the same standards as these longstanding stations. Finally, this analysis is necessarily limited as it focuses on only two stations. I do not intend to assert that the results reflect all station developments in Tokyo, nor that all station developments are RICs.

6.4 Background to the stations

6.4.1 Jiyugaoka

Jiyugaoka station is located at the southern end of Meguro ward, one of the Tokyo 23 wards, and is close to both central Tokyo and the City of Yokohama. The station area also encompasses Setagaya ward to the south of the station. On the Toyoko Line it is six stations away from Shibuya station in central Tokyo to the east and 14 stations away from Yokohama station to the west, as can be seen in Fig. 7 below.

Figure 7: Location of Jiyugaoka station



Jiyugaoka station in relation to Shibuya station along the Yamanote loop line in central Tokyo to the east, and Yokohama station to the west.

Source: jseikei.com <http://www.jseikei.com/clinic.html>

The station began life as Kuhonbutsu station in 1927 with the opening of the Toyoko⁴⁵ line between Shibuya station and Maruko-Tamagawa station by the Tokyo-Yokohama Electric Railway (Sekita, 2008). The line between Tokyo and Yokohama was completed the following year, greatly increasing passenger traffic. A rather rustic place when it first opened, the station became an important transfer point with the opening of the north-south Oimachi line in 1929 by the Meguro-Kamata Electric Railway (Ibid), at which time the name was then changed to Jiyugaoka. It was named after a private high school that had opened near the station shortly after the opening of the Toyoko line.

In a 2007 survey, Jiyugaoka was rated #2 behind Kichijoji as the most desirable place to live in Tokyo, and was particularly popular with housewives

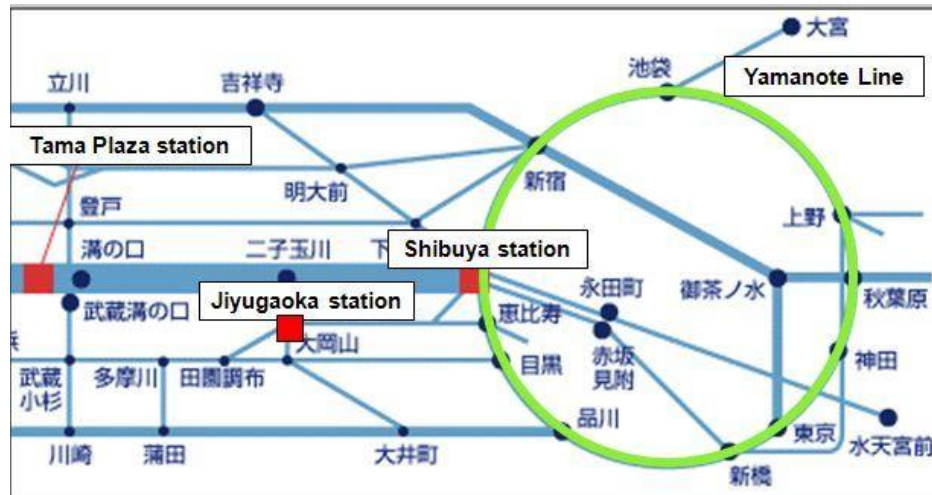
⁴⁵ The line takes its name from this fact, a shortening of **T**okyo-**Y**okohama Line (Ibid).

and men over 50 (Home's Club, 2007). Reasons given were its quiet location somewhat removed from the central city, secure environment, sophisticated image and the numerous appealing shops and services (Ibid). Jiyugaoka also ranked #2 in a survey by real estate developer Haseko Urbest, cited for its green spaces, quiet residential areas, walkability, and easy access to fashionable shops and services (Haseko Urbest, 2007). In fact, stations along Tokyu train lines took four of the top 10 spots in the same survey, with Futago-Tamagawa at #6, Musashi-Kosugi at #8, and Den-en Chofu at #9 (Ibid).

6.4.2 Tama Plaza

Tama Plaza station is situated in the northwest corner of the City of Yokohama, eight stations from the border with Tokyo Metropolis and 19 minutes away from Shibuya station by express train (Tokyu Corporation, 2009). As seen in Fig. 8, passengers can ride from Tama Plaza station straight through to Shibuya station in central Tokyo without changing trains.

Figure 8: Map of Tama Plaza station in relation to Shibuya and Jiyugaoka stations



Tama Plaza station in relation to Shibuya and Jiyugaoka stations, both highlighted in red. Source: Kogakuin University http://www.cic.or.jp/tamapla/student/img/student_21.gif

Prior to the opening of the Tokyu Den-en-toshi line in 1966, the area was mostly fields, with only one small shopping street (Tamapla Scope, 2007). Tama Plaza station was constructed as part of Tokyu Corporation’s massive Tama Den-en-toshi development, built on a 4,300 hectare stretch of the Tama hills across the four cities of Kawasaki, Yokohama, Yamato, and Machida City in Tokyo (Keiei Jōhō Centre, 1971). Planning began in 1953 and construction started in 1966 with the opening of the Den-en-toshi line (Ibid). It is now described as a “...a lively town with a harmonious blend of residential neighbourhoods and commercial areas” (Tamapla Scope, 2007).

6.5 Summary of RIC indicators

This section provides a summary of the ten RIC indicators for Jiyugaoka and Tama Plaza stations. A more detailed discussion can be found in Appendix

C, which provides the context for each of the indicators and describes the data in greater detail. It is highly recommended that the introductions to each of the indicators in Appendix C be read in order to provide some background to them as well as a frame of reference for understanding the data.

Jiyugaoka station is served by both the Toyoko line and the Oimachi line, while Tama Plaza is served by the Den-en Toshi line. Jiyugaoka station had an average daily ridership in 2005 of 186,437 boardings, 188,409 alightings, and 684,514 through passengers, while Tama Plaza station had 42,444 boardings, 42,600 alightings, and 390,918 through passengers (Table 1). Average daily ridership was 1,095,072 on the Toyoko line, 373,939 on the Oimachi line, and 1,161,781 on the Den-en Toshi line (Table 1).

Tokyu can offer a very high quality of transit service due to the high ridership created by the dense communities surrounding the station as well as the schools, businesses, and government facilities that draw people from other parts of the region. Frequency is high enough that a train schedule is not necessary. Trains arrive on average every 2.5 minutes in the morning peak period, every 3 minutes in the evening peak period and about every 3 to 5 minutes during the off-peak and on the weekend (Table 1). Average load factor can exceed 170% on the busiest section of the line (Table 1), but this has been an improvement over previous years due to investment in double tracking rail lines. As well, the cost of commuting by train is low. A monthly commuter pass from Jiyugaoka to Shibuya in central Tokyo costs 5,710 yen (\$57 USD or €43

Euro), while from Tama Plaza it costs 9,030 yen (\$90 USD or €68 Euro), as shown in Table 1. In Japan, this expense is generally paid by the employer.

As shown in Table 2, commuters using Jiyugaoka station arrive mainly on foot (70.5%), followed by bus (13.2%), bicycle (11.2%), and motor vehicle (4.5%). Tama Plaza station also had a majority of passengers walking to the station (57.2%), followed by motor vehicle (29.2%), bus (11.0%), and bicycle (2.6%). Aoba ward, where Tama Plaza station is located, had 270 transit rides per capita per year, versus 315 for the whole of the City of Yokohama (Table 2). Data was unfortunately not available for Setagaya or Meguro wards. Bus usage is surprisingly low, since most riders live very close to the station and can walk or cycle there. In terms of mode connections, there are only 3 bus routes leaving from Jiyugaoka and 6 bus routes from Tama Plaza (Table 2). The almost equal number of parking spaces for automobiles and bicycles in Table 2 reflects the high mode share of cycling as well as the high land values surrounding the stations, where land is usually too valuable to use as surface parking.

Both Jiyugaoka and Tama Plaza have densely populated station areas. As seen in Table 3, population density within 500 metres of the station is 12,808 persons per km² around Jiyugaoka station and 13,046 km² around Tama Plaza station. The average density of the surrounding wards was higher for Jiyugaoka but lower for Tama Plaza, reflecting the fact that the former area was developed much earlier and is also closer to the central city. The number of persons per household was slightly higher around Tama Plaza (2.26) compared with Jiyugaoka (1.85).

Data for pedestrian injuries and deaths is only collected at the ward and city level, so station area numbers were unavailable. Nonetheless, even looking at the ward level, Table 3 shows that pedestrian deaths per 100,000 traffic accidents were low, with none in Meguro ward, 1.82 per 100,000 in Setagaya ward, and 1.69 per 100,000 in Aoba ward. The crime rate in Aoba ward (Tama Plaza station) was 7.01 incidents per 1,000 people per year, compared with 14.43 for Setagaya ward and 13.81 for Meguro ward (Jiyugaoka station). All three rates were lower than Japan's average of 19.20 incidents per 1,000 people.

Table 1: Ridership and quality of service

RIC Indicators for Jiyugaoka and Tama Plaza stations		Jiyugaoka (Toyoko Line)	Jiyugaoka (Oimachi Line)	Jiyugaoka Total	Tama Plaza (Den-en Toshi line)
Ridership at station	Average daily boardings	105,045	81,392	186,437	42,444
	Average daily alightings	108,218	80,191	188,409	42,600
	Average daily through passengers	477,146	207,368	684,514	390,918
Commuting		Setagaya Ward	Meguro ward		Aoba ward
	Percentage of riders commuting to the 23 wards	82.1%	85.8%		65.0%
	Percentage of riders commuting within the ward	2.8%	1.3%		3.5%
	Average commute time (minutes)	55	50		70
	Average monthly commuter pass cost to Shibuya station (yen)	12,167	10,731		14,533
Quality of service - Frequency		Toyoko Line	Oimachi Line		Den-en Toshi Line
	Morning peak hours (trains per direction per hour)	25	20		26
	Off peak hours (trains per direction per hour)	18	12		12
- Hours of service	Hours of service per day (weekday)	19.67	19.5		19.47
	Hours of service per day (weekend)	19.62	19.5		19.47
- Crowding	Passenger load (peak %)	173%	No data		194%

Table 2: Transit rides per capita per year, mode share, mode connections, and parking spaces

RIC Indicators for Jiyugaoka and Tama Plaza stations		Setagaya and Meguro wards	Aoba ward
Transit rides per capita per year		no data	270
Mode share: Primary means of transportation (%)	Train	no data	26.8%
	Walk		38.0%
	Automobile		4.0%
	Cycle		26.0%
	Bus		5.2%
Mode share: To and from station (%)		Jiyugaoka station	Tama Plaza station
	Walk	70.5%	57.2%
	Automobile or other motor vehicle	4.5%	29.2%
	Cycle	11.8%	2.6%
	Bus	13.2%	11.0%
Mode connections (number of bus routes from station)		3	6
Parking spaces within 500m of station			
	- Number of automobile spaces	569	776
	- Number of bicycle spaces	673	665

Table 3: Population density, persons per household, dwellings per hectare, property values within and beyond 500m of station, pedestrian safety, and crime rate

RIC indicators for Jiyugaoka and Tama Plaza	Setagaya Ward	Meguro ward	Jiyugaoka station area	Tama Plaza station area	Aoba ward	City of Yokohama	Tokyo 23	Tokyo Metro	Japan
Population density (Persons per km ²)	14,841	18,282	12,808	13,046	8,577	8,402	14,057	5,894	329
Persons per household	1.93	1.83	1.85	2.26	2.41	2.34			
Dwellings per hectare	73.2	100.1	69.2	57.8	35.4	35.8			
Property values (yen per m ²)									
- Within 500m of station (under 5 min walk)			1,375,900	697,500					
- Beyond 500m of station (5 to 10 minute walk)			947,700	537,000					
- Beyond 500m of station (10 to 15 minute walk)			854,700	445,000					
- Beyond 500m of station (15 to 20 minute walk)			862,300	424,900					
Pedestrian safety (Death rate from traffic accidents per 100,000 people)			0.0		1.69	2.40		0.61	5.78
Crime rate (incidents per 1,000 people)	14.43	13.81			7.01				19.20

7. IMPLICATIONS AND CONCLUSIONS

7.1 Creating successful rail integrated communities in Tokyo

Tokyo's rail integrated communities (RICs) have resulted from the innovation of Japanese private railways as well as Japanese government policies that have facilitated their success while providing only limited subsidies. These high density, mixed-use, safe, pedestrian-friendly developments around railway stations are the centres of community life in Tokyo. Served by frequent, all-day, rail transit, most RIC residents don't need to use an automobile to move around their neighbourhood or the rest of the city. The national government has also made driving an expensive proposition, while at the same time subsidizing commuter passes and regulating fare increases. As a result of all this, the mode share for walking, cycling, and transit is greater than for driving and the Tokyo region enjoys "...arguably the most sustainable pattern of regional development among any of the world's megacities" (Cervero, p. 206, 1998).

Due to the early nationalization of main trunk lines by the national government, private railways needed to find ways to increase ridership and create alternate sources of revenue. Hankyu Electric Railway in Osaka had great success through real estate development along rail lines that terminated in entertainment and recreation complexes. Tokyu Corporation took this a step further by also recruiting schools and universities to situate themselves next to

Tokyu's rail lines. Not only did this increase the prestige of Tokyu's developments, it expanded its ridership base dramatically.

By adopting an innovative diversification strategy, Japanese private railways such as Tokyu were better able to adapt to the impact of car culture when it eventually arrived in the mid- to late 1960s. Favourable market conditions (densely populated cities with concentrated urban cores) and national government policies and regulations that support public transit and discourage car ownership have improved rail profitability. These factors coupled with a diversified approach to the railway business have allowed private railway companies in Japan to build the stable ridership needed to survive and thrive.

7.2 Limitations and further research

The focus of this project was the RICs created by Tokyu Corporation, and therefore took only a cursory look at Japan's other private railways. While there is much to be gained from a case study of a single company, it would be instructive to see how other major Japanese private railways are run, especially in another major metropolitan area such as Osaka. Local railways in Japan which service smaller, less dense communities in rural areas would be another worthy topic of study, especially to learn how these railways function in locations that are not experiencing population growth. Japan Rail would also make an interesting case study of the sorts of developments that have been created around interurban railways as opposed to intraurban railways.

Jiyugaoka and Tama Plaza stations were selected for an extensive analysis as successful examples of Tokyo RICs. However, beauty is in the eye of

the beholder, and there are many other good candidates for analysis in Tokyo Metropolis. The definition of success also varies depending on the station; while the number of transit riders may be the main criterion in more auto-oriented, suburban locations, a high mode share for transit, cycling, and walking to the station may be more important in central city locations where road space is more limited. Additional indicators to study the environmental impact of RICs could also be added, such as vehicle km travelled, gasoline consumption, or sulphur dioxide emissions per capita.

Moreover, not all of Tokyo Metropolis' station areas are created alike. Many are not as well planned and designed as Jiyugaoka, Tama Plaza, and other Tokyu Corporation stations. In addition, the high rates of transit usage found in this study do not necessarily hold true across the whole region; population density and transit mode share generally decrease as the distance from central Tokyo increases. As Jiyugaoka and Tama Plaza have each had at least 40 years to densify and solidify their ridership base, it would be instructive to also look at historical indicators to see how quickly this took place, especially when planning for new RICs. A study charting the movement in indicator values of recent RICs developed in eastern Tokyo before and after development would help to show the speed at which indicators like population density and train ridership can change.

It is hoped that in future, research will be conducted on additional RICs in Tokyo Metropolis and other Japanese cities. The Japanese Ministry of Land, Infrastructure, Transport, and Tourism has an exhaustive database of statistics

with which it could create a separate report on RIC indicators for Japanese cities with little additional data collection. Besides introducing a benchmark for future RIC development, these indicators would help to introduce RICs to a wider world.

7.3 Lessons from the Japanese private railway model for North American transit systems

While North American transit systems saw record ridership in 2008 due to high fuel costs, ironically this has also impacted the budgets of transit systems, with many U.S. systems considering fare increases or service cuts (Mieszkowski, 2008). A spokeswoman for the American Public Transit Association president recently noted that "...we don't have the funding to expand public transportation systems" (Ibid, p.1). When public transportation systems rely solely on revenue from fares topped up by public funding, it limits their ability to provide quality service with existing systems, much less have room for expansion. And while transit agencies could potentially finance their operating costs through fare revenue, "...social and political objectives often drive the fare" (Anderson, 2006, p. 24).

A report by the Transportation Association of Canada on innovative financing for urban transportation states that "Capital, operating, and maintenance funding should be stable over time, predictable in magnitude, and provide long term financial commitment to new vision" (TAC, 2002, p. 2).

TransLink, the transit agency for Vancouver and its surrounding region, was singled out as having an innovative funding approach. It recovers the 60% of its funding for operational costs not covered by transit fares through a variety of

taxes⁴⁶: gasoline taxes, property taxes, parking sales taxes, and a BC Hydro levy (Ibid, p. 7).

Hopefully it has been made clear in this study that Japan has developed an automobile culture as strong as any in the world, although it occurred much later than in North America. Perl (2002, p. 43) also concludes that there is "...little evidence to support the claim that European and Japanese patterns of growth in road and air mobility are structurally different from those found in North America." But this automobile culture coexists with urban private railways that have been among the most profitable and well-respected enterprises in Japan.

Rather than relying strictly on farebox revenue and taxation, transit agencies in North America should be freed to develop other revenue sources, as the Japanese private railways have done with great success. Above all, real estate development holds great promise for transit agencies if they can either capture a portion of land price increases generated by extending rail lines, or develop land around existing stations that is currently occupied by park-and-ride lots. More transit agencies are starting to come around to the idea that real estate development is an integral part of developing new rail lines. To take one example, the Los Angeles County Metropolitan Transportation Agency (MTA), has undertaken joint development along new subway lines, such as the Hollywood/Highland mall above a station on the Red line (Vasquez & Mayer, 2009).

⁴⁶ In 2000, transit fares covered 40% of operating costs (\$224 million CDN), gasoline taxes 33% (\$181 million), property taxes 17% (\$93 million), BC Hydro levy 3% (\$16 million), and parking sales taxes 2% (\$10 million), with a shortfall of \$28 million (TAC, 2002, p. 17).

North American transit agencies also need to stop treating passengers like packages that need to be shipped from location to location, and instead think of them as potential consumers of products and services that could bring in needed funds that would reduce or eliminate government subsidies. The first step would be to emulate the Japanese railways by creating stations that include shops and services inside and outside the ticket gates that cater to passenger needs. A good analogy would be a place like Disneyland, which excels at retailing to a captive audience.

By regulating the fares that the Japanese private railways can charge, but allowing them the freedom to diversify into almost any business, the Japanese government has created an environment that has allowed the railways to flourish in Japan's metropolitan areas. Importantly, the connection between land use and transportation has been strengthened due to the large role that real estate development plays in the profitability of the railways. By diversifying into other businesses which are aimed at increasing rail ridership, Japanese private railways have created profits for themselves while also providing an efficient public transit system that provides a valuable social service.

APPENDICES

Appendix A: Suburban Electric Streetcar Lines up to 1921

Railway	Date opened
Keihin Electric Railway (<i>Keihin Denki Tetsudo</i>)	January 21, 1899
Tamagawa Electric Railway (<i>Tamagawa Denki Tetsudo</i>)	March 6, 1907
Oji Electric Tramway (<i>Oji Denki Kido</i>)	August 20, 1911
Keisei Electric Tramway (<i>Keisei Denki Kido</i>)	November 3, 1912
Keio Electric Tramway (<i>Keio Denki Kido</i>)	April 15, 1913
Joto Electric Tramway (<i>Joto Denki Kido</i>)	December 30, 1917
Seibu Railway (<i>Seibu Tetsudo</i>)	August 26, 1921

Source: Arisue, 1970, p. 195

Appendix B: New Electric Railways 1920-1940

Railway	Date opened
Ikegami Electric Railway (<i>Ikegami Denki Tetsudo</i>)	October 6, 1922
Meguro-Kamata Electric Railway (<i>Meguro-Kamata Dentetsu</i>)	March 11, 1923
Tokyo-Yokohama Electric Railway (<i>Tokyo-Yokohama Dentetsu</i>)	February 14, 1926
Odawara Express Railway (<i>Odawara Kyuko Tetsudo</i>)	April 1, 1927
Shonan Electric Railway (<i>Shonan Denki Tetsudo</i>)	April 1, 1930
Teito Electric Railway (<i>Teito Dentetsu</i>)	August 1, 1933

Source: Arisue, 1970, p. 197

Appendix C: Station Indicators for Jiyugaoka and Tama Plaza

1. Train ridership (boardings, alightings, and through passengers)

Train ridership in Japan is undoubtedly helped by the fact that a high percentage of Japanese live within walking distance of a railway station. As of 2003, 19.7% lived within 500m of a station, increasing to 40.7% within 1000m, and 64.5% within 2000m (Ministry of Internal Affairs and Communications Statistics Bureau, 2003). And these numbers are increasing; this last figure represents a 2% increase over 1998. Of owner-occupied dwellings, 35.1% were within 1,000m of a station, while 49% of rental dwellings were within this range (Ibid). People in Japan prefer to live close to train stations: in a survey looking at how satisfaction levels varied with distance from a station, the highest percentage of satisfied respondents (30%) were a five minute walk from the station, with the next highest percentage (28%) living within a three minute walk of a station (Kagoshima, 2002). On the other hand, dissatisfaction levels increased the farther people lived from a station (Ibid).

Jiyugaoka

The Oimachi and Toyoko lines converge at Jiyugaoka station, making it one of the busier hubs in the Tokyu network. Average daily ridership for Jiyugaoka station as a whole in 2005 was a total of 186,437 boardings, 188,409 alightings, and 684,514 through passengers, who are those who ride through the station without stopping (Ministry of Land, Infrastructure, Transport, and Tourism,

2005a). Average daily ridership in 2005 on just the Toyoko line was 105,045 boardings, 108,218 alightings, and 477,146 through passengers. Riders were evenly split between commuter pass holders (49%) and cash fares (51%) (Tokyu Corporation, 2007a). Ridership on the Oimachi line was a bit lower, with an average of 81,392 boardings, 80,191 alightings, and 207,368 through passengers. Commuter pass holders were only 38% of riders, while the remaining 62% were cash fares (Tokyu Corporation, 2007a). The average daily ridership on the Toyoko line in 2006 was 1,095,172 passengers, while the Oimachi line transported 373,939 passengers (Tokyu Corporation, 2007a).

Riders commuting from Setagaya ward were mainly headed for Tokyo's 23 wards (82.1%), while only 2.8% were commuting within Setagaya ward (Ministry of Land, Infrastructure, Transport, and Tourism, 2005). In Meguro ward, 85.8% commuted to Tokyo's 23 wards, while only 1.3% worked in Meguro ward itself (Ibid). The average commute time from home to work was 55 minutes for Setagaya ward and 50 minutes for Meguro ward (Ibid).

Tama Plaza

The Den-en-toshi line connects Chuo Rinkan station in the east with Shibuya station in the west, with Tama Plaza station lying in the middle. The entire station area is in Aoba ward, part of the City of Yokohama. Average daily ridership in 2005 for Tama Plaza was 42,444 boardings, 42,600 alightings, and 390,918 through passengers (Ministry of Land, Infrastructure, Transport, and Tourism, 2005). Commuter pass holders were 52% of riders, with 48% were cash

fares (Tokyu Corporation, 2007a). The average daily ridership on the Den-en-toshi line as a whole was 1,161,781 passengers (Ibid).

The majority of commuters (65.0%) from Aoba ward, as in Setagaya and Meguro wards, commute to work in Tokyo's 23 wards (Ministry of Land, Infrastructure, Transport, and Tourism, 2005). However, almost a third (30.7%) were travelling to locations in Kanagawa Prefecture, while only 3.5% of commuters worked in Aoba ward itself (Ministry of Land, Infrastructure, Transport, and Tourism, 2005). The average commuter in Aoba ward took 70 minutes to travel from home to work (Ibid).

2. Quality of service (frequency, hours of service, passenger load, commuter pass cost)

Headways (time between trains) average only two minutes in central Tokyo and waits are generally under a minute (Cervero, 1998). On Tokyu's lines, frequency is also very high. Data for frequency and hours of service for Jiyugaoka and Tama Plaza stations in the following paragraphs was calculated from Tokyu Corporation timetables (Tokyu Corporation, 2009). The average price for a monthly commuter pass in 2005 was 12,034 yen (\$119 USD or €88 Euro) in Tokyo Metropolis and 11,342 yen in the 23 wards (Ministry of Land, Infrastructure, and Transport, 2005). Setagaya ward averaged 12,167 yen (\$121 USD or €89 Euro) per month, while Meguro ward was 10,731 yen (\$106 USD or €78 Euro) (Ministry of Land, Infrastructure, and Transport, 2005). Aoba ward, farther away from Tokyo, had an average monthly commuter pass cost of 14,533

yen (\$144 USD or €106 Euro) (Ministry of Land, Infrastructure, and Transport, 2005).

Jiyugaoka

Trains on the Tokyu Toyoko line from Jiyugaoka station to Shibuya station in Tokyo run approximately 20 hours per day, from 5:09am to 12:49am (12:37am on weekends) eastbound and from 5:13am to 12:57am (12:47 on weekends) westbound. There are 25 eastbound trains per direction per hour (pdph) in the morning peak period, 20 pdph in the evening peak period, and an average of 18 trains pdph in off-peak hours. It takes 11 minutes to reach Shibuya by local train or 9 minutes by express train. The highest average load factor⁴⁷ on the Toyoko line in 2007 was 173%⁴⁸, between Yutenji station and Shibuya station, slightly to the east of Jiyugaoka station (Ministry of Land, Infrastructure, Transport, and Tourism, 2005b).

The Tokyu Oimachi line also connects with Jiyugaoka station, running north to south from Futago Tamagawa-en station to Oimachi station. While the Oimachi line doesn't go directly to central Tokyo, commuters who want to reach Tokyo anywhere south of Shibuya take the southbound train, which connects with the Meguro and Ikegami lines. Trains run southbound every day of the week from 5:08am to 12:38am and northbound from 5:13am to 12:48am. There are 20

⁴⁷ While the average load factor in Tokyo has been significantly reduced since its peak in the mid-1960s, morning commutes at peak times are generally not pleasant experiences. The average load factor in Tokyo Metropolis has fallen from 221% in 1975 to 170% in 2005, due to improved passenger transportation capacity and slightly lower passenger volumes since a peak in 1990 (Ministry of Land, Infrastructure, Transport, and Tourism, 2005).

⁴⁸ A load factor of 100% = all seats and overhead straps taken, equal to 3 passengers in 1 m² of floor space (Ieda, 1995); 150% = Shoulders come in contact, passengers able to easily read a newspaper; 180% = Bodies come in contact, able to read newspaper; 200% = Sensation of pressure, able to read magazine, equal to 7 passengers in 1 m²; 250% = Unable to move arms, unable to switch position, equal to 9 passengers in 1 m². (Source: Tokyo Ministry of Land, Transportation, Infrastructure, and Tourism, 2005b).

southbound trains pdph in the morning peak period and 16 pdph in the evening peak period. The off-peak average is 12 trains pdph, the same as the weekend average.

A commuter pass or *teiki-ken* from Jiyugaoka station to Shibuya station costs 5,710 yen (\$57 USD or €42 Euro) for one month, 16,280 yen (\$161 USD or €119 Euro) for three months, and 30,840 yen (\$306 USD or €225 Euro) for six months. Student fares are 2,370 yen, 6,760 yen, and 12,800 yen respectively.

Tama Plaza

Trains run eastbound from Tama Plaza station to Shibuya station in Tokyo from 5:17am to 12:45am and westbound from 5:02am to 12:47am every day of the week. During the morning peak periods from 7am to 9am, there are 26 eastbound trains pdph, or one train every 2 to 3 minutes. In the evening peak period from 5pm to 7pm, there are 18 trains per direction per hour, with trains arriving every 3 to 4 minutes. During off-peak hours the average is 12 trains phpd, which is the same as on weekends. It takes 27 minutes to reach Shibuya by local train or 19 minutes by express train, which arrives every second or third train on both weekdays and weekends. On the Den-en-toshi line the highest average load factor was 194% between Ikejiri-Hashi station and Shibuya station (Ministry of Land, Infrastructure, Transport, and Tourism, 2005b).

A commuter pass from Tama Plaza station to Shibuya costs 9,030 yen (\$90 USD or €66 Euro) for one month, 25,740 yen (\$255 USD or €188 Euro) for three months, and 48,770 yen (\$484 USD or €356 Euro) for six months. Student fares are 3,780 yen, 10,780 yen, and 20,420 yen respectively.

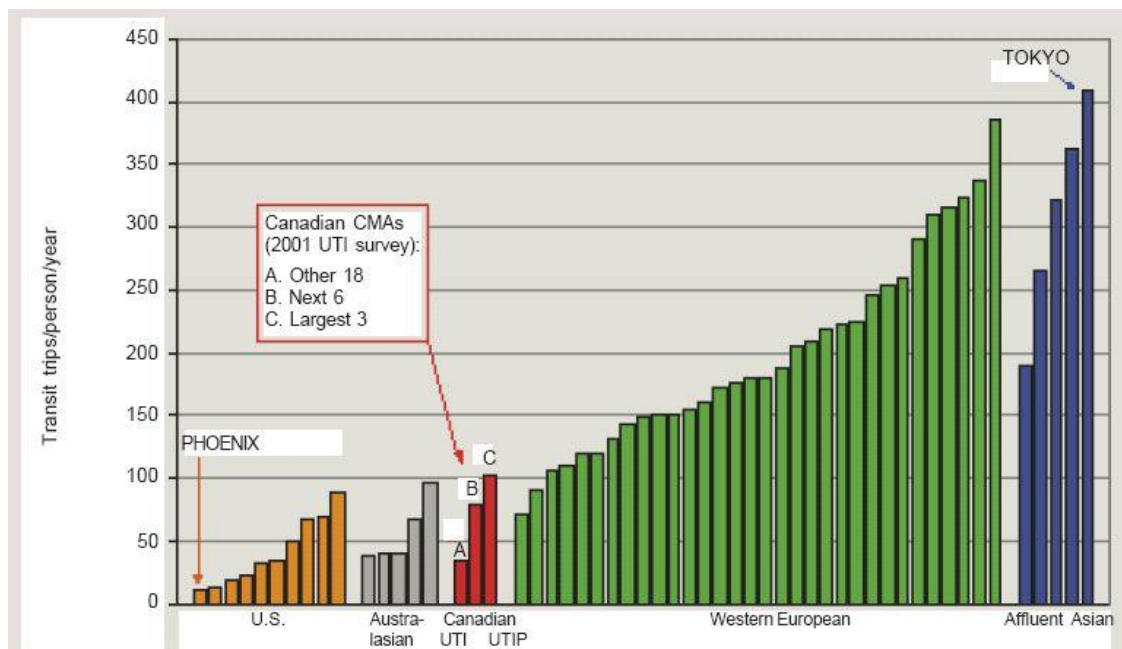
3. Transit rides per capita and mode share (primary means of transportation & between home and station)

Vuchic (2005) lists *modal split* between different forms of transportation and *transit rides per capita per year* as the two of the most common indicators for expressing the relative and absolute magnitude of public transit in a city. Tokyo's 23 wards have one of the highest rates of transit usage in the world, with an average of 410 rides per year per capita (TAC, 2005). This compares with 560 trips in Zurich (Project for Public Spaces, 2008) and 194 rides in New York-Newark⁴⁹ (Urban Transport Fact Book, 2000). High-quality transit is very important in contributing to a high level of transit usage. Vuchic (2005) notes that transit usage in Western European cities has increased as their transit systems have improved, with even mid-sized cities like Rotterdam and Hamburg having 150-200 annual rides per capita.

In Canada, transit rides per capita (boardings) for the metropolitan regions were 181 in Toronto, 224 in Montreal, and 145 per capita in Vancouver (TAC, 1996). One can see the huge difference between Tokyo and North American cities in Fig. 9, a bar chart of annual transit trips per capita created in 2001 by the Union Internationale des Transports Publics (UITP).

⁴⁹ The number of transit rides per capita per year in U.S. cities was generally over 200 and even as high as 400 when transit was basically the only choice for medium- and long-distance trips prior to World War II (Vuchic, 2005).

Figure 9: Transit trips per person per year by region



In a survey of 57 affluent urban regions, the U.S., Australia, and Canada had fewer transit trips per capita per year than most of Western Europe, while Tokyo topped the list. Source: TAC, 2005

In terms of modal split, 25.5% of the population of Tokyo Metropolis in 1998 took the train as their primary means of transportation (City of Yokohama Urban Development Bureau, 1998). This figure increases to 41.5% for Tokyo's 23 wards (Ibid). A full 71% of commuters in Tokyo Metropolis use the train, increasing to 91% of commuters bound for the 23 wards (Ieda, 1995). Automobiles represent 33.2% of mode share for Tokyo Metropolis, but only 15.3% in the 23 wards. Both walking and cycling have high mode shares, at 14.5% and 22.3% in Tokyo Metropolis and 14.9% and 23.8% in the 23 wards (Ibid).

In metropolitan areas of Canada, the percentage of trips to work taken on transit in 2006 was 22% in the Greater Toronto Area, 21% in Greater Montreal,

and 17% in Greater Vancouver (Statistics Canada, 2008b). Percentages were higher for work trips on transit to the central business district, at 64%, 58%, and 35% respectively in a 1999 survey (TAC, 1999). The survey also found that one in five Canadians either use public transit (10.3%), walk (6.4%), or cycle (1.3%) to work (Ibid). Canadian and Western European cities have achieved higher transit modal-split shares than U.S. cities because they have higher population densities and are less decentralized and polycentric than U.S. cities (Transportation Research Board, 2001, in Pucher, 2004).

An extensive study by the Ministry of Land, Infrastructure, Transport, and Tourism in 1999 looked at mode share for the three largest urban agglomerations in Japan (*daisan toshiken*), which includes Tokyo, Osaka, Kyoto, Nagoya and their surrounding towns (Ministry of Land, Infrastructure, Transport, and Tourism, 1999). The differences in rail usage are striking; while 21% of respondents in cities used the railway as their primary means of transportation, only 3.6% in the 77 smaller towns and cities did so (Ibid). However, this doesn't mean that everyone else in Japan is driving. The automobile was the primary mode of transportation for 35.1% of respondents in cities, versus 53.6% in smaller towns (Ibid). Walking and cycling are both popular transportation modes, at about 22% and 15% in both cities and smaller towns alike (Ibid).

Jiyugaoka

While detailed data by city area was not available, area data for Tokyo Metropolis could be calculated from the overall results of the 1999 Person Trip

Survey conducted by the Ministry of Land, Infrastructure, Transport, and Tourism (1999). With residents making an average of 3.27 trips per week by train or bus, this works out to an average of 170 trips per capita per year for Tokyo Metropolis. As mentioned earlier, this number increases to 410 trips per capita per year when looking at just the 23 wards (TAC, 2005).

In terms of mode share for those travelling to Jiyugaoka station, I combined the data for the Oimachi and Toyoko lines. The result was that 70.5% of commuters walk to the station, 13.2% take the bus, 11.8% cycle, and only 4.5% drive a car, ride a motorbike, or take a taxi (Ministry of Land, Infrastructure, and Transport, 2005a). Average commute time to the station was between 5 and 8 minutes, except for bus, which averaged 14 minutes⁵⁰. Since most commuters walk to the station, bus service is not as extensive as would be expected in North America with similar ridership numbers.

Tama Plaza

Although transit rides per capita per year is not a statistic provided by Japanese local governments, an estimate was calculated based on the Person Trip Survey conducted in 1998 by the City of Yokohama (City of Yokohama Urban Development Bureau, 1998). Aoba ward had a population of 256,753 in 1998, with residents making an average of 630,000 trips per day. A total of 30.1% of residents use public transit as their primary mode of transportation, with 26.8% of residents using rail and 3.3% taking the bus. Therefore, 189,630 trips per day are taken by public transit, or 69,214,950 per year. With a population of

⁵⁰ In the Tokyo Metropolitan Area, the average commute time to the train station was 10 minutes on foot, 11 minutes by bicycle, 11 minutes by automobile, 11 minutes by motorcycle, and 14 minutes by bus (Ministry of Land, Infrastructure, Transport, and Tourism, 2005a)

256,753 in 1998, Aoba ward residents take an average of 270 transit trips per capita per year. City of Yokohama residents made 8,720,000 trips per day, with 33.1% of residents taking public transit. With a population of 3,344,654 in 1998, Yokohama residents averaged 315 transit rides per capita per year.

Of those taking the train at Tama Plaza, 57.2% walk to the station, 29.2% take the bus, and 11.0% take a car, motorbike, or taxi (Ministry of Land, Infrastructure, and Transport, 2005a). Average commute time to the station was between 9 and 11 minutes, except for bus, which averaged 16 minutes. When looking at Aoba ward residents' primary means of transportation, rail had a mode share of 26.8%, automobile 38.0%, bicycle 4.0%, and walking 26.0%.⁵¹

The mode share for rail in the City of Yokohama has been on the increase, from 25.7% in 1968 to 28.7% in 1998, while automobile's share increased from 17.2% to 29.8% in the same period, mostly at the expense of walking trips (City of Yokohama Urban Development Bureau, 1998).

4. Number of mode connections

Bus networks cover most of Tokyo Metropolis, but are mainly used as a feeder system to the railways. Less than 3% of total commuting trips in Tokyo Metropolis are taken by bus (Yajima, 2000). Bicycles and foot power are much more popular in Tokyo, especially when the distance to the nearest station is quite short. Community buses, run by the local wards, run on limited routes and

⁵¹ For commuting to and from work, mode share for rail in Aoba ward increases to 60.0%, while automobile's share decreases to 26% (Ministry of Land, Infrastructure, and Transport, 2005).

are mainly geared at the elderly population. Intermodal mobility is quite limited, however, as there are no bicycle carriers on buses in Tokyo.

There are 21,300 km of bus routes in Tokyo Metropolis, 95% of which are run by eleven private companies (Yajima, 2000, p. 624), including Tokyu Bus Corporation. The remaining 5% are run by the Transportation Bureau of the Tokyo Metropolitan Government (Ibid). Plazas in front of train stations that allow smooth transfers between train and bus have been constructed through the cooperation of rail operators and the government (Ieda, 2000).

Jiyugaoka

There are only 3 bus routes from Jiyugaoka station, two of them going by way of the nearby Komazawa University campus (Tokyu Bus Corporation, 2009a). Buses run from 6:30am to 11:15pm for a fare of 210 yen, increasing to 410 yen between 11:15pm and the last bus at 1am (Ibid).

Tama Plaza

Tokyu Bus Corporation runs buses along 6 main routes departing from Tama Plaza station, generally from 6:30am to 11:15pm for a flat fare of 210 yen (Tokyu Bus Corporation, 2009b). Late night buses run from 11:30pm to 1am, when the fare increases to 410 yen. Tokyu Bus shares the running of long

distance buses between the station and Narita Airport, Haneda Airport, and Tokyo Disneyland with other bus companies (Ibid).⁵²

5. Parking spaces within 500m of station (automobile and bicycle)

Parking lots near stations have far fewer spaces than in North America or Europe⁵³, and the concept of park-and-ride is largely unknown in central Tokyo. Generally there are many small parking lots near stations rather than large surface lots. There is little on-street parking in the station areas, and where it exists, parking is limited to only a few hours. The lack of parking and the fact that many people live within walking distance of a station means that most people access it on foot or by bicycle.

Jiyugaoka

Within 500m of Jiyugaoka station there are 70 automobile parking lots with a total of 569 spaces (S-Park, 2008). Most of these are very small, with the largest only 120 spaces, and the station has no officially designated park-and-ride lot. As well, there are two bicycle parking lots with a total of 673 spaces (Meguro Ward, 2008a). The one run by Meguro ward at the south exit has 250

⁵² Tama Plaza ~ Narita Airport buses run 24 times per day, with Tokyu Bus, Odakyu Bus, and Keisei bus each running 8 buses per day (Tokyu Bus Corporation, 2009b). Tama Plaza ~ Haneda buses run 39 times a day, with Tokyu, Odakyu, and Kawasaki Tsurumi each running 13 buses per day. Tokyu and Keisei share the running of the Tokyo Disneyland bus, which runs 10 times per day every day of the week (Ibid).

⁵³ In 2006 Setagaya ward had 37 pay parking lots with 15,186 spaces, for an average of 18.5 parking spaces per 1,000 people, while Meguro ward had 12 pay parking lots with 1,179 spaces, for an average of 4.7 spaces per 1,000 people (Tokyo Metropolitan Government, 2008). In 2006 the City of Yokohama had 340 pay parking lots with 83,909 spaces, for an average of 23.3 spaces per 1,000 people (City of Yokohama, 2006).

spots and charges 2,600 yen (\$26 USD or €19 Euro) per month (Ibid). The Setagaya ward bicycle parking lot is located to the southwest of the station and holds 423 bicycles; 303 spaces are for monthly users and 120 spaces are reserved for daily use on a first-come first-served basis (Setagaya Ward, 2009a). The monthly charge is between 1,800 and 2,000 yen (\$18 to \$20 USD or €13 to €15 Euro). Meguro ward now has a municipal ordinance that new or renovated buildings must provide a certain number of bicycle parking spaces (Meguro Ward, 2008b). For example, for eating and drinking establishments over 400 square metres, one bicycle parking space must be provided for each 20 square metres of space (Ibid).

Tama Plaza

There are a total of 776 parking spaces for automobiles within 500m of Tama Plaza station as well as one bicycle parking lot⁵⁴ with 665 spaces (Goo Housing and Real Estate, 2008). Automobile parking costs on average 400 yen (\$4 USD or €3 Euro) per hour, while bicycle parking costs 100 yen per day or 2000 yen per month (\$20 USD or €15 Euro) (Ibid). As shown earlier, mode share for automobiles is about 11% for Tama Plaza, with much of this share being passengers dropped off in front of the station. Since the vast majority of commuters use modes other than the automobile to access Tama Plaza station, parking spaces are used either for people shopping in the area or as storage location for their automobile. There is no park-and-ride lot at the station.

⁵⁴ In Aoba ward in 2006, there were a total of 7,626 bicycle parking spaces, giving an average of 25.8 spaces per 1,000 people (City of Yokohama, 2006).

6. Population density (persons per km²) and housing density (dwellings per hectare)

While Japan is not a small country, the population of 127.3 million (CIA World Factbook, 2007) must squeeze onto the country's scarce flat land, which makes up only one-eighth of the country (Mather, 1997) due to its extremely mountainous terrain. Japan's population density overall is 329 persons per km², increasing to 1,000 per km² when land covered with mountains and forest is not included (Koide & Oyama, 1998). Therefore, cities like Tokyo have been compelled to develop in a compact and efficient manner, where every metre of space is used to its fullest potential. Residential lots are particularly small, ranging from 100 m² to 400 m² (Kurokawa, 1998). This concentration of land use is particularly favourable to public transit, while making congestion from extensive use of private cars more likely (Jones, 1983). According to Mather (1997, p. 41), the primary characteristics of Japanese urban landscapes that result are: 1) a paucity of idle land, 2) interdigitation (land is subdivided into relatively small parcels, with a mixture of agricultural, industrial, service, and residential uses), 3) compactness, 4) meticulous organization, and 5) immaculateness. These characteristics, while important, are difficult to measure directly.

According to Mather (1997, p.40), "The challenge of modern and urban Japan is basically to organize compactly, three-dimensionally, efficiently, and interconnectedly". Land is rarely left vacant, even for a short time, and there are no exclusions on any major land use type (Ibid). Zoning is used to increase

density, and minimum building heights are often required to realize this level of density (Callies, 1997).

The population density of Tokyo is 4.5 times higher than greater New York City, as Tokyo holds a total population that is one and a half times greater in an area less than one third the size (Hirooka, 2000). While Tokyo Metropolis has an overall density of 5,894 per km², the density of the 23 wards is 14,057 per km², with the highest density in Nakano ward at 20,123 per km² (Tokyo Metropolitan Government, 2009). All of Tokyo's 23 wards, with the exception of Chiyoda and Minato wards, have a density in excess of 10,000 persons per km² (Ibid).

Canadian and Western European cities have higher average population densities than cities in the U.S., but lower than Japanese cities. Kenworthy (2002, in Pucher, 2004) determined that large Western European cities had an average population density of 5,500 persons per km² in 1995, Canadian cities 2,600 persons per km², and American cities 1,500 persons per km², while outer suburban densities were 3,900, 2,600, and 1,200 persons per km², respectively.

In terms of large American cities, New York City's density is the highest at 10,194 per km², with Manhattan the densest at 27,257 per km² (U.S. Census Bureau, 2000). In Canada's major cities, the urbanized area of Montreal has 2,522 persons per km², followed by Toronto at 2,474 per km², and 619 per km² in Vancouver (TAC, 1996). Vancouver's densest neighbourhood, the West End, had about 23,400 persons per km², while Kitsilano, with a mix of single family homes and apartments, had 7,800 persons per km² (GVRD, 2003). Looking specifically at an example of developments around railway stations, population

density within 500m of the Expo SkyTrain line in Vancouver increased from 2,990 persons per km² in 1986 when the line opened to 4,890 persons per km² in 2001, an increase of 46% (GVRD, 2006).

Jiyugaoka

The Jiyugaoka station building lies entirely within Meguro ward, but the 500 metre area surrounding the station extends south into Setagaya ward. The whole area consists of seven zones: Jiyugaoka 1-Chome, Jiyugaoka 2-Chome, and Fujigaoka 2-Chome are part of Meguro ward to the north of the station. South of the station are Okuzawa 2-, 5-, and 6-Chome and Tamagawa Den-en Chofu 2-Chome, which are in Setagaya ward. The total area of the seven zones is 1.49 km² with a population of 19,063 people (Tokyo Metropolitan Government, 2009). Average density for the seven zones was calculated to be 12,808 persons per km², compared with 18,282 persons per km² in Meguro ward and 14,841 persons per km² in Setagaya ward (Ibid). Setagaya ward is Tokyo's most heavily populated, with 862,000 residents, and while Meguro ward has only a population of 268,750⁵⁵, it has the 4th highest population density of Tokyo's wards (Ibid).

There are 10,294 households in the Jiyugaoka station area, for an average of 1.85 persons per household, versus 1.83 in Meguro ward and 1.93 in

⁵⁵ Meguro ward saw an overall decline in population from its peak of 300,000 in 1965 to a low of 243,100 in 1999 (Meguro Ward, 2007). Since then the population has rebounded to 252,795, with a population density of 17,197 per km² (4th highest in the 23 wards) within a total area of 14.7 km² (Meguro Ward, 2009). The total number of households is 139,793, giving it an average of 1.81 persons per household in 2009 (Ibid). The average has slowly been dropping year by year, going back at least as far as 1975, when the average was 2.4 persons per household (Meguro Ward, 2007). Single households now make up 47.2% of the total, with couples at 18.0%, and couples with children at 21.1%.

Setagaya ward (Tokyo Metropolitan Government, 2009). The average in Japan in 2003 was 2.7 persons per household, a drop of 1.58 persons per household since 1963 (Ministry of Internal Affairs and Communications, 2003). Housing density was 69.2 dwellings per hectare in the 1.49 km² of the Jiyugaoka station area, compared with 100.1 dwellings per hectare in Meguro ward and 73.2 dwellings per hectare in Setagaya ward⁵⁶.

Tama Plaza

The area around Tama Plaza station lies entirely within Aoba ward in the City of Yokohama. The area roughly within 500m of the station is composed of five zones: Utsukushi-ga-oka 1-Chome, 2-Chome, and 5-Chome are north of the station, while Shin-Ishikawa 2-Chome and 3-Chome are south of the station. The area totals 1.84 km² with a population of 24,004. Average density for the five zones is 13,046 persons per km², compared with 8,577 persons per km² in the rest of Aoba ward (City of Yokohama, 2009a). The average density for the City of Yokohama is similar, at 8,402 persons per km² (City of Yokohama, 2009b). The average number of persons per household was 2.26 in the Tama Plaza station area, versus 2.41 in Aoba ward. In Aoba ward, 28% of the population is within 500m of a train station, 66% within 1 km, and 91% within 2 km (City of Yokohama, 2003). The City of Yokohama has 1,559,152 households in a population of 3,654,532 (Ibid), giving it an average of 2.34 persons per household.

⁵⁶ Setagaya ward is the most heavily populated of the 23 wards, with a population of 828,886 in an area of 58.08 km², giving it a population density of 14,288 persons per km² (Setagaya Ward, 2009b). It has 432,364 households, equalling 1.92 persons per household (Ibid).

Housing density in the Tama Plaza station area was calculated to be 57.8 dwellings per hectare, while for Aoba ward the number was lower at 35.4 dwellings per hectare, similar to the 35.8 dwellings per hectare in the City of Yokohama (City of Yokohama, 2009b).

7. Property values within and beyond 500m of station

The presence of a passenger rail line is very often associated with higher land values and increased rents as shops and services become accessible to more people. A study by Weinberger (2000) found that office properties within the catchment or service area up to 800m (one half mile) away from the Santa Clara County LRT Rail were able to charge a higher lease rate than other properties in the County. This premium decreased as distance from the rail lines increased. Increases in property values have also been noted by Cervero and Landis (1995) along the BART system in Oakland and San Francisco. In Denver, Colorado, homes less than 800m (half a mile) from a light rail station increased an average of 17.6% in the two years since the line opened, compared with only a 0.1% increase for those between 2.4 km and 3.2 km (1.5 to 2 miles) away from a station (Jackson, 2008).

As well, in a study of the Buffalo LRT, Hess & Almeda concluded that “a typical home located within one-quarter of a mile of a rail station can earn a premium of \$1300 to 3000, or 2 to 5% of the city’s median home value” (2007, p. 1062). They also make an interesting point that the “...*apparent* (emphasis added) proximity to rail stations is an added locational advantage compared with physical walking distance to the station” (Ibid, p. 1041). In other words, although

a property may be beyond walking distance to a station due to natural or man-made barriers, proximity to a rail station maintains a positive effect on property values.

One can see from Fig. 10 below how this holds true for property values along train lines in Tokyo Metropolis, with the stations forming little 'islands' of higher value property. Note especially how the lands to the southwest developed by Tokyu Corporation, including Tama Plaza and Jiyugaoka, garner a price premium even outside a 10 km radius from the centre of the city. Only the Odakyu Odawara line and the Keio line, which are slightly to the north of the Tokyu developments, can compete in terms of land prices at such a distance from central Tokyo.

Figure 10: Land price distribution map of Tokyo for 2007

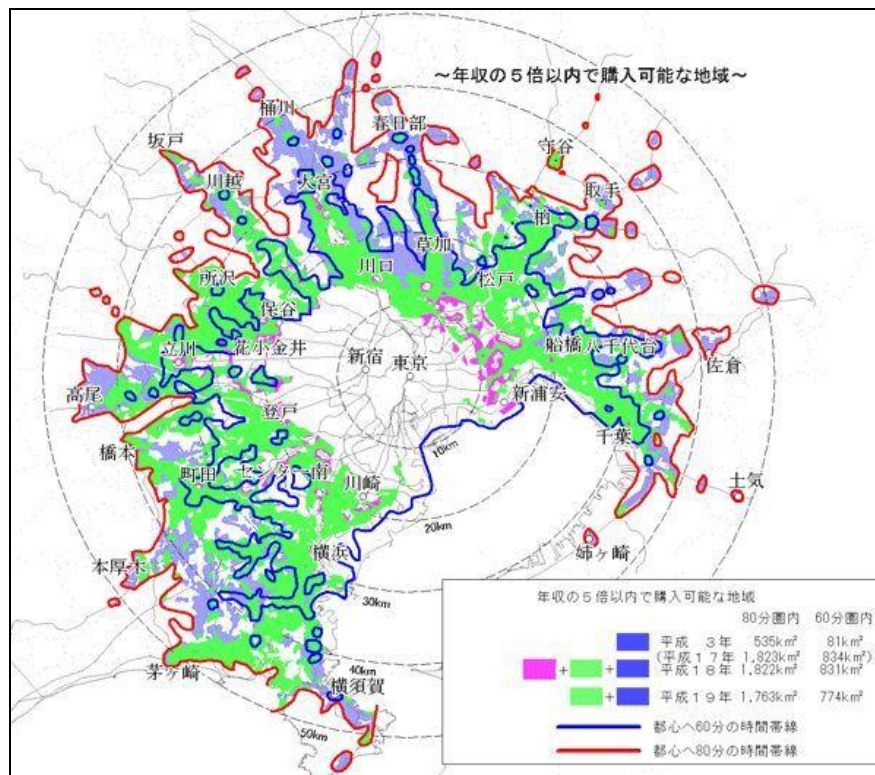


Dark blue = Land price of than 700,000 yen per m², light blue 600,000~700,000 yen per m², red 450~600,000 yen per m².

Source: Tokyu Land Corporation <http://www.tokyu-land.co.jp/map/chikabunpu/h19s/s-chika.html>

Affordability is a major issue in a large, densely populated city like Tokyo. Land has become relatively more affordable since the collapse of Japanese asset price bubble in the early 1990s. Total affordable land within a 60 minute commute increased from 81 km² in 1991 to 774 km² in 2007, as shown in Fig. 11 (Tokyo Land Corporation, 2007). Affordable land is defined as that which can be purchased for less than five times annual income, equivalent to a purchasing an existing single family home at a price of 300,000 yen (\$2,975 USD or €2195 Euro) per m².

Figure 11: Land in the Tokyo Metropolitan Area that can be purchased for less than five times annual income



Blue shaded areas show where land can be purchased for less than 5 times annual income. Blue line represents a 60 minute train ride from the city centre, while the red line represents an 80 minute train ride. Source: Tokyo Land Corporation <http://www.tokyu-land.co.jp/map/chikabunpu/h19s/s-buy.html>

Jiyugaoka

Land prices⁵⁷ near Jiyugaoka station in late February, 2009 were about double the price of land near Tama Plaza station, at 1,375,900 yen (\$13,650 USD or €10,065 Euro) per m² under a 5 minute walk, 947,700 yen (\$9,405 USD or €6,940 Euro) between 5 and 10 minutes, 854,700 yen (\$8,475 USD or €6,250 Euro) per m² between 11 and 15 minutes, and 862,300 yen (\$8,550 USD or €6,305 Euro) per m² between 16 and 20 minutes (Beans-Coop, 2009). The standard for apartment listings Japan is that a one minute walk equals a distance of 80m, so a distance of 500m corresponds to 6.25 minutes, or within the 5-10 minute time frame (O-Heya Sagashi Tatsujin, 2009). Vuchic (2005) also cites the standard of a one minute walk corresponding to an 80m distance. A distance of 1200 metres, or a 15 minute walk, is considered the maximum that people will walk to a station (Ibid). Land prices drop a significant 93,000 yen (\$922 USD or €680 Euro) between the 400m to 800m distance (5 to 10 minutes' walk away from the station) and the 800m to 1200m distance (11 to 15 minutes' walk away from the station).

Rental prices within a ten minute walk (800m) of the station were 109,900 yen (\$1,090 USD or €805 Euro) for a 1DK⁵⁸, 255,400 (\$2,533 USD or €1,870 Euro) for a 2LDK⁵⁹, and 289,000 (\$2,866 USD or €2,115 Euro) for a 3LDK (Ensen Home's, 2009). The rental price for a 1DK 11 minutes or more away from the station was 122,000 yen (\$1,210 USD or €895 Euro), slightly higher than

⁵⁷ Prices were converted from *tsubo* to square metres. One *tsubo* = 3.3 square m²

⁵⁸ A 1DK has one Room, one Dining room, and one Kitchen; A 1LDK has one room + one Living room + one Dining room + one Kitchen.

⁵⁹ A 2 DK or LDK has one additional room; A 3 DK or LDK has two additional rooms

closer to the station. For 2LDKs and 3LDKs, prices were about 10,000 yen lower than closer to the station, at 244,500 and 281,100 yen (\$2,425 and \$2,790 USD or €1,790 and €2,060 Euro) respectively.

Tama Plaza

Land prices around Tama Plaza station in late February, 2009 were 697,500 yen (\$6,920 USD or €5,105 Euro) per m² below a five-minute walk from the station, 537,000 yen (\$5,329 USD or €3,930 Euro) per m² between a 5 and 10 minute walk, 445,000 yen (\$4,415 USD or €3,255 Euro) per m² between a 11 and 15 minute walk, and 424,900 yen (\$4,217 USD or €3,111 Euro) per m² between a 16 and 20 minute walk (Beans-Coop, 2009). We can see that land prices become lower as distance from the station increases, with a drop again of 92,000 yen (\$913 USD or €675 Euro) as we move from the 400m to 800m distance to the 800m to 1200m distance from the station.

Rental prices within a 10 minute walk (800m) of Tama Plaza station range from 69,800 yen (\$693 USD or €511 Euro) for a 1DK, 125,100 yen (\$1,241 USD or €916 Euro) for a 2LDK, and 173,300 yen (\$1,720 USD or €1,270 Euro) for a 3LDK (Ensen Home's, 2009). Rental prices 11 minutes or more away from the station were lower overall: 67,300 yen (\$670 USD or €490 Euro) for a 1DK (about 21 m² / 226 sq. ft) , 116,000 yen (\$1,151 USD or €849 Euro) for a 2LDK (52m² / 560 sq. ft), and 129,000 yen (\$1,280 USD or €945 Euro) for a 3DK (70m² / 754 sq. ft).

8. Quality of streetscape design

I spent one day at both Jiyugaoka and Tama Plaza stations on May 13th and 14th, 2008, exploring the station buildings, observing how rail passengers accessed the station, and examining the design of the station area and surrounding streets. Browning (2007, p.1) observes that “Japanese streets do not aspire towards a consistent identity or narrative mission...”; rather, they “...emphasize juxtaposition and variety.” The variety encourages pedestrian activity and enlivens the street at all hours of the day.

The diversity of uses is an outcome Japan’s more relaxed attitude towards zoning, especially compared with Western Europe and North America. Relatively little land is devoted to specialized use in Tokyo, and different uses are mixed together to a high degree. As Karan (1997, p. 3) explains, “A street whose principal identity during the evening is that of bar and cabaret district becomes, during the day, a street of houses with children playing outside.” It also is very common for an owner to operate a business as a coffee shop during the day and as a bar at night. With land at a premium, mixed use and multiple use is a given. In fact, with the exception of the Imperial Palace and Haneda Airport, no single land use in Tokyo covers more than one square kilometre (Masai, 1998). Fujita and Hill (1997, p. 115) explain the reason for this:

The Japanese Civil Code regards land and the buildings on it as separate real estate. Land, even in the city, is often owned by families for generations. Consequently, the growth of Japanese cities is more negotiated and less systematically planned than in the West.

Under the 1968 City Planning Act, “City planning areas” are approved by the Ministry of Construction and are the basic territorial unit in the Japanese planning system (Simian, 1989). All urban planning and development activities take place in these areas, which follow the agglomeration pattern rather than municipal boundaries. The division of Japanese cities into urbanization and non-urbanization zones means that parts of the city are technically unzoned (Callies, 1997). In contrast, once a city adopts zoning in the Canada or the United States, all land is generally zoned. Within the city planning area, there is an urban control area and an urban promotion area, with eight basic land-use zones (Ibid). Fujita & Hill (1997, p. 115) note that “The scope of land use is most restricted in residential areas where factories are prohibited, less so in commercial areas where small scale factories are allowed, and least of all in industrial zones where factories are approved.” The land use zones also tend to encroach on each other, which further mixes land uses (Ibid).

Jiyugaoka

The streets around Jiyugaoka station were laid out prior to the arrival of the automobile, and are therefore much narrower than in most North American cities. There are no sidewalks, just white painted lines on the road that are more guidelines than anything. As can be seen in Fig. 12, delivery trucks freely park in this area, bicycles are left at odd angles outside shops, and pedestrians walk right down the middle of the street. One way streets are rare, so drivers have to be nimble to avoid cyclists, pedestrians, and other vehicles. However, vehicle

speeds were observed to be very low in the station area. As the distance from the station increases, roads become wider, and the major roads will have pedestrian spaces, separated not by grade but by handrails. Commercial areas gradually give way to offices, schools, and other facilities, and eventually apartments and single family housing less than a five minute walk from the station.

Figure 12: Shopping street near the main exit of Jiyugaoka station



Source: Google maps

There are generally no alleys for back door delivery, so all activity takes place through the front of the shops. Garbage collection is usually daily and bags are left outside the shop fronts. The streets around the station are alive with activity and lined with restaurants, pachinko parlours, coffee shops, flower shops, bars, ramen shops, fast food places, upscale boutiques, bakeries, department stores, language schools, and drug stores. Not only the first floor is used for

commercial activity; retail and restaurants will locate on the 2nd, 3rd, or 4th floors of buildings, usually advertising with a signboard in front of the building. The commercial buildings in Jiyugaoka are not much to look at, and are often covered with large commercial signage. The interiors of shops and stores were generally more inviting than the exteriors would suggest, something which is very common in Japan.

There are two exits for Jiyugaoka station, one main north exit and one south exit (Fig. 13). The main exit has a bus rotary out front crowded with passenger vehicles, taxis, and delivery trucks. The main exit is much more auto-oriented than the south exit, which is much more pedestrian-oriented although it does allow cars. A subtle indicator is that the road surface outside the south exit is made of brick parquet, while the outside the main exit it is asphalt. Tokyu Department Store and high-end shops are prominent south of the station.

Figure 13: Views of Jiyugaoka station



**Left photo is of the main exit to the station, right photo is of the south exit.
Source: John Calimente**

The Jiyugaoka *koban*, or police box, is co-located within the station, near the main exit, and is staffed by two police officers during the day. Streets in

Japan are usually not named, so the police officers of the *koban* are often called upon to give directions. I found the station to be busy at all hours of the day with commuters in the early morning, students in mid-morning, housewives and university students shopping and socializing during the day, then in the evening a rush of workers returning home or going out to eat and drink. Because of the constant buzz of people and the presence of a police box, the streets never felt unsafe.

Tama Plaza

Tama Plaza is not as upscale as Jiyugaoka, and seems aimed more at the middle class consumer with a family than more upscale consumers, students, or young single people. Tama Plaza's street grid was laid out when Tokyu Corporation designed Tama Den-en Toshi in the late 1950s. As such, it has a feel closer to a North American suburb than does Jiyugaoka. For one thing, the station itself occupies a large footprint, so that it takes a quite a few minutes to get to shops and services beyond the station. Of course, Tokyu's intention is probably to channel as many customers into its stores as much as possible. The station is now getting a makeover, and the new design is quite striking (Fig. 14).

Figure 14: Views of Tama Plaza station



Left photo is looking towards the north exit, right photo is looking away from the north exit towards Tokyu Department Store. Source: John Calimente

Another important point is the separation between pedestrians and automobiles that exists around Tama Plaza that was absent around Jiyugaoka station. Main roads all have sidewalks and are designed more with automobiles in mind. Surface parking also seems much more prevalent around Tama Plaza station. The activity of the station seems to take place mostly indoors, inside the station and the adjoining Tokyu Department Store. Apartments are much more common in the area surrounding Tama Plaza station, particularly social housing and company dormitories. I had to travel farther from the station to see single family homes than I did at Jiyugaoka station.

However, what is most striking is the lack of vibrancy and activity at Tama Plaza station compared with Jiyugaoka, even though station area densities are similar. One reason is that Jiyugaoka is a 'destination station', especially attracting women in their 30s and 40s to shop and socialize. Tama Plaza is what

the Japanese call a 'bed town', or a place to lay one's head at night. It is not a destination in and of itself. However, another reason for the lack of vibrancy is the station area design. By catering more to the automobile and taking a more controlled approach than the more mixed street scenes of older neighbourhoods, quite a different station environment has been created. While some may prefer the quiet of Tama Plaza's station area, in my opinion the earlier designs predating the automobile are far more appealing.

9. Pedestrian safety

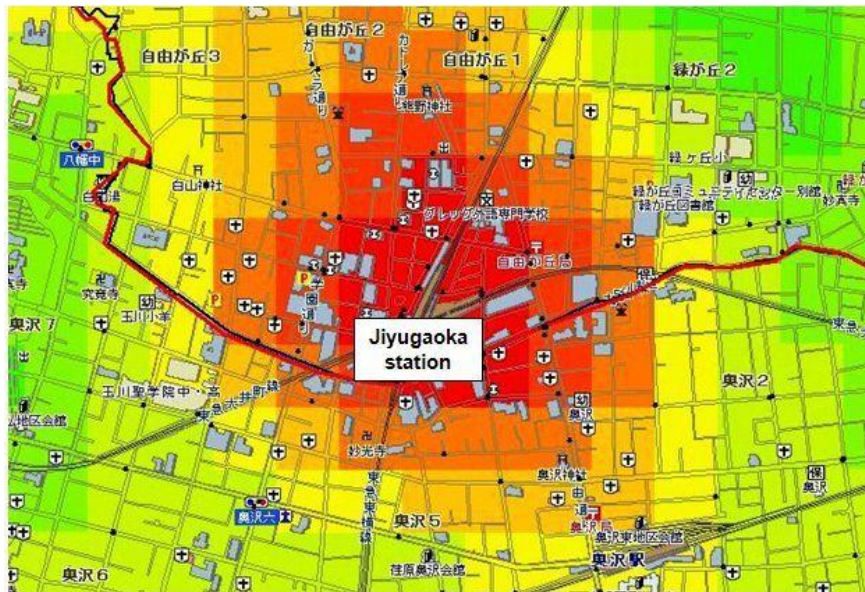
In the Tokyo metropolitan area in 2008, there were a total of 61,525 traffic accidents causing injury or death, with 218 deaths and 69,666 injured (Tokyo Metropolitan Police, 2009). This amounts to an exceedingly low per capita death rate of 0.61 per 100,000 people, compared with 5.78 for Japan (Drive and Stay Alive Inc, 2004). In the most recent breakdown available, pedestrian deaths made up 36.5% of total traffic deaths in Tokyo Metropolis in 2007, followed by motorcyclists (30.2%), motor vehicle occupants (18.7%), and bicyclists (14.6%) (Tokyo Metropolitan Police, 2008).

Jiyugaoka

In Setagaya ward there were 1,017 traffic accidents in 2007, with 1,177 people injured (7 seriously) and 7 deaths, for a per capita death rate of 1.82 per 100,000 people. In Meguro ward there were 836 accidents with 909 people injured (5 seriously) and no deaths (Tokyo Metropolitan Police, 2009b), giving a per capita death rate of 0.0 per 100,000 people. Fig. 15 below shows traffic

accidents per km² in 2008 around Jiyugaoka station (Tokyo Metropolitan Police, 2009c). Black dots represent accidents resulting in injuries. No traffic deaths were recorded in the station area in 2007 or 2008.

Figure 15: Traffic accidents per km² around Jiyugaoka station in 2008



Red areas show 120 incidents per km² or greater, orange shows 75-120 incidents per km², light green to yellow represent 30-75 incidents per km², dark green represents 15-30 incidents per km². Source: Tokyo Metropolitan Police, 2009c

Tama Plaza

In Aoba ward there were 1,569 traffic accidents in 2006, with 5 deaths and 57 seriously injured (City of Yokohama, 2007) for a per capita death rate of 1.69 per 100,000 people. The City of Yokohama, with a total of 87 deaths and 784 seriously injured due to 20,557 traffic accidents in 2006, had a per capita death rate of 2.40 per 100,000 people (Ibid). Pedestrians were involved in 4% of all traffic accidents causing injury in the City of Yokohama, and made up 5.7% of all traffic deaths (Ibid).

10. Crime rate in ward where station is located

The crime rate for Japan is 19.2 crimes per 1,000 people, much lower than the U.K. (85.6), the U.S. (80.1), and Canada (75.5) (Nationmaster.com, 2000a). Its murder rate is also much lower, with 0.49 murders per 100,000 people, versus 4.28 in the U.S., 1.41 in the U.K., and 1.49 in Canada (Nationmaster.com, 2000b). But surprisingly, the number of police officers on a per capita basis is not significantly higher. Japan has 1.81 police officers per 1,000 people, compared with 1.71 for Canada, 2.01 for the U.K., and 2.63 in the U.S. (Nationmaster.com, 2000c).

One reason for the effectiveness of the police is the extensive use of community policing whereby *koban*, or police boxes, are located in small buildings within the community, and staffed 24 hours per day. *Koban* are often co-located with station buildings, which is the case at Jiyugaoka station. Fig. 16 shows a map of a typical police station area, this one in Himonya north of Jiyugaoka station, with 10 *koban* in a 7.5 km² area of 130,000 people, including one *koban* at each Toyoko line station (Himonya District Police Station, 2007).

The job of the two or three officers in each *koban* is to maintain the safety of a certain neighbourhood by regular patrols, offering consultation and advice, educating citizens in traffic safety, as well as engaging in more mundane tasks like giving directions and keeping lost and found items (Koide & Oyama, 1998). Officers in the *koban* talk with each household in their neighbourhood at least once a year, something called *junkai renraku*, or regular patrol contact (Nagano Police, 2006). Information is collected on each member of the household, such

Figure 16: Area supervised by the Himonya District Police Station



Supervised area is north of Jiyugaoka station, located at the bottom left of the map.

Source: Himonya District Police <http://www.keishicho.metro.tokyo.jp/3/himonya/koban/koban.htm>

as their place of work or school, or the number of employees if it is a business (Ibid). Officers will drop by the station at least five times per day to talk with station staff about any potential problems that day (Tokyu Corporation, 2008). As well, Tokyu station staff write up a daily report on any incidents that have occurred and how they were dealt with (Ibid).

Jiyugaoka

The station area of Jiyugaoka station lies in both Meguro ward to the north and Setagaya ward to the south. Meguro ward had 3,470 crimes in 2007, a rate of 13.81 per 1,000 people (Tokyo Metropolitan Police, 2007a). In Setagaya ward there were 11,845 crimes at a rate of 14.43 per 1,000 people (Ibid). Both rates are lower than the Japanese average of 19.20 mentioned earlier. In both wards, vehicle theft was the most frequent crime, followed by shoplifting, burglary, and

violent crime (Ibid)⁶⁰. While more detailed statistics are not publicly available, the Tokyo Metropolitan Police does publish a crime information map, shown in Fig. 17. While crimes are higher around station areas, the incidence rate is low, with the highest incident rate north of the station only 137 to 286 crimes for all of 2007 (Tokyo Metropolitan Police, 2007b).

Figure 17: Jiyugaoka station area crime incidence map - 2007



Light orange indicates 137-286 incidents per year; Yellow 66-136; Light green 29-65; Dark green 1-28. Source: Tokyo Metropolitan Police, 2007b

Tama Plaza

Aoba ward, where Tama Plaza station is located, recorded 2,103 crimes in 2008, for a rate of 7.01 incidents per 1,000 people (Kanagawa Prefectural Police,

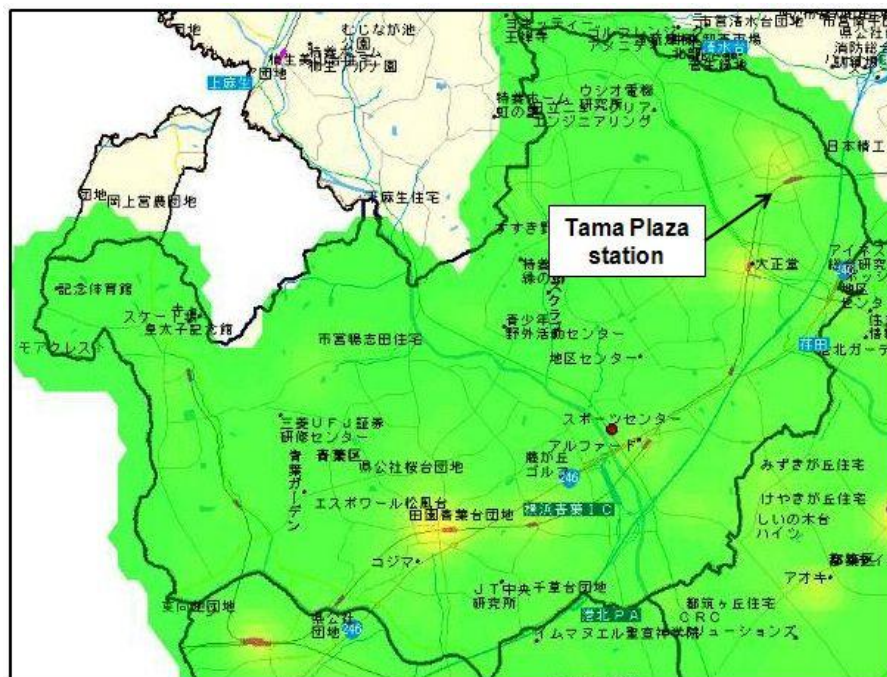
⁶⁰ Breakdown of crimes committed in Setagaya and Meguro wards (Tokyo Metropolitan Police, 2007a):

Setagaya ward: Other – 39.0%, Robbery – 0.3%, Burglary – 5.6%, Purse snatching – 1.0%, Car break-ins – 2.6%, Vehicle theft – 38.6%, Baggage theft – 2.2%, Shoplifting – 5.7%, Violent crime – 4.3%, Sex-related crime – 0.6%

Meguro ward: Other – 43.5%, Robbery – 0.3%, Burglary – 5.9%, Purse snatching – 2.0%, Car break-ins – 3.3%, Vehicle theft – 31.1%, Baggage theft – 2.5%, Shoplifting – 6.3%, Violent crime – 4.2%, Sex-related crime – 0.8%

2009). The highest incidences of crime⁶¹ were bicycle theft (13.3%), burglary (7.8%), motorcycle theft (7.1%), and automobile theft (5.1%). Violent crime made up only 0.14% of incidents. As can be seen in Fig. 18, the commercial area to the north of the station has a slightly higher crime rate than the surrounding area.

Figure 18: Aoba ward crime incidence map - 2007.



Tama Plaza station is the red box in the northwest of Aoba ward.

Source: Kanagawa Prefectural Police, 2009

⁶¹ Breakdown of crimes committed in Aoba ward in 2008 (Kanagawa Prefectural Police, 2009): Total incidents – 2,595; Violent crime – 5 (0.19%); Purse snatching – 31 (1.2%); Bicycle theft – 451 (17%); Motorbike theft – 171 (6.6%); Automobile theft – 57 (2.2%); Burglary – 250 (9.6%)

REFERENCE LIST

- Aoki, E. (1994). Expansion of railway network. *Japan Railway & Transport Review*, 2, 34-37.
- Aoki, E., Imashiro, M., Kato, S., & Wakuda, Y. (2000). *A history of Japanese railways 1872-1999*. Tokyo: East Japan Railway Culture Foundation.
- Anderson, R. (2006). *Metro benchmarking yield tangible results*. Energy Regulatory Office monthly report. Retrieved from <http://www3.imperial.ac.uk/pls/portallive/docs/1/8595697.PDF>
- Arisue, T., & Aoki, E. (1970). The development of railway network in the Tokyo region from the point of view of metropolitan growth. In Association of Japanese Geographers. (Ed.), *Japanese cities: A geographical approach*. (pp. 191-200). Tokyo: Association of Japanese Geographers.
- Asano, M. (1998). Urban transportation and environment. In Golany, G., Kanaki, K., & Koide, O. (Eds.), *Japanese Urban Environment*. (pp. 252-264). Oxford, UK: Elsevier Science Ltd.
- Association of Japanese Private Railways (AJPR). (2007). *Profile of the 16 major private railways (大手16社紹介)*. Retrieved from <http://www.mintetsu.or.jp/corporate/companys/tokyu/index.html>
- Automobile Inspection & Registration Information Society (AIRIA). (2007, August 9). *Extent of passenger vehicles per household: vehicles per household decrease to 1.107 (自家用乗用車の世帯あたり普及状況：マイカーは1世帯1.107台に後退)*. Retrieved from www.airia.or.jp/publish/pdf/happyou/2008_08setai.pdf
- Babbie, E & Benaquisto, L. (2002). *Fundamentals of social research*. Scarborough: Thomson/Nelson.
- Baig, M. (2008, September). Automobiles can banish unemployment and poverty. *Chowk*. Retrieved January 22, 2008, from <http://www.chowk.com/articles/automobiles-can-banish-unemployment-and-poverty-murad-a-baig.htm>
- Beans-Coop. (2009). *Real estate market by station (駅別土地相場)*. Retrieved February 20, 2009, from http://beans-coop.jp/market_tochi_station.html

- Bernick, M., & Cervero, R. (1996). *Transit villages in the 21st century*. New York: McGraw-Hill.
- Browning, R. (2007). *Lanes, lanterns, and lessons: a handbook to the streetscapes of southern Japan*. Self-published.
- Butler, D. (2009, February 14). A new route for public transit. *Ottawa Citizen*. Retrieved from <http://www2.canada.com/ottawacitizen/news/observer/story.html?id=2c5f9337-b507-47b5-9966-29106dbcea4c>
- Callies, D. (1997). Urban land use and control in the Japanese city: a case study of Hiroshima, Osaka, and Kyoto. In Karan, P., & Stapleton, K. (Eds.), *The Japanese City*. (pp. 134-155). Lexington: The University Press of Kentucky.
- Canadian Urban Transit Association. (2008). *Summary of Canadian transit statistics – 2007 operating data*. Toronto: Canadian Urban Transit Association.
- CBC News. (2005). *Canadian obesity rates rise dramatically in 25 years*. Retrieved January 30, 2009, from <http://www.cbc.ca/health/story/2005/07/06/obese050706.html>
- Cervero, R., & Landis, J. (1995). *BART at 20: land use impacts*. Paper presented at the 74th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1995.
- Cervero, R. (1998). *The transit metropolis: a global inquiry*. Berkeley: Island Press.
- Cervero, R., Ferrell, C., & Murphy, S. (2002). *Transit oriented development and joint development in the United States: a literature review*. Washington, DC: Transit Cooperative Research Program, Project H-27.
- CIA World Factbook. (2007). *Japan – people*. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/print/ja.html>
- City Mayors Statistics. (2005). *The 150 richest cities in the world by GDP in 2005*. Retrieved from <http://www.citymayors.com/statistics/richest-cities-2005.html>
- City Mayors Statistics. (2007). *The largest cities in the world by land area, population, and density*. Retrieved from <http://www.citymayors.com/statistics/largest-cities-population-125.html>

- City of Yokohama Engineering Office. (2006). *Information on bicycle parking lots in the ward (区内自転車駐車場案内)*. Retrieved from http://www.city.yokohama.jp/me/aoba/doboku/parking_info/
- City of Yokohama Statistics Portal Site. (2003). *2003 housing and land statistics survey (平成15年住宅・土地統計調査)*. Retrieved January 15, 2009 from <http://www.city.yokohama.jp/me/stat/census/jutakutochi0310.html>
- City of Yokohama Statistics Portal Site. (2006). *Number of vehicles and pay parking lots (自動車台数及びしなない有料駐車場数)* Retrieved January 15, 2009 from <http://www.city.yokohama.jp/me/stat/daitoshi/new/h131200.html>
- City of Yokohama Statistics Portal Site. (2007). *Traffic accidents by area (交通事故発生状況 (行政区別))*. Retrieved from <http://www.city.yokohama.jp/me/stat/keywords/k-koutsuujiko.html>
- City of Yokohama Statistics Portal Site. (2008). *Tokyo Kyuko Toyoko line passenger numbers (東京急行東横線乗車人員)*. Retrieved January 15, 2009 from <http://www.city.yokohama.jp/me/stat/toukeisho/new/t091307.xls>
- City of Yokohama Statistics Portal Site. (2009a). *Index by area – Aoba ward (町丁別インデックス)*. Retrieved February 8, 2009, from <http://www.city.yokohama.jp/me/stat/jjinko/cho/new/aoba.html>
- City of Yokohama Statistics Portal Site. (2009b). *Yokohama population news: back number 990 (横浜人口ニュースバックナンバー)*. Retrieved February 10, 2009, from <http://www.city.yokohama.jp/me/stat/jjinko/news0902-j.html>
- City of Yokohama Urban Development Bureau. (1998). *Overview of the results of the previous (1998) person trip survey (前回 (平成10年) のパーソントリップ調査の結果概要)* Retrieved from http://www.city.yokohama.jp/me/toshi/kikaku/pt/h10_data/
- Colliers International. (2008). The ten most expensive places to park. *The Money Hospital*. Retrieved from <http://www.moneyhospital.co.uk/blog/post/the-10-most-expensive-places-to-park>
- Department for Planning and Infrastructure, Government of Western Australia. (2006). *Transit oriented development performance indicators*. Retrieved from: <http://www.dpi.wa.gov.au/cityregionalplanning/15683.asp>
- Dittmar, H., & Ohland, G. (2003). *The new transit town: best practices in transit-oriented development*. Berkeley: Island Press.

- Doi, T. (2004). Towns built by the railroad (鉄道で築いた都市). In Kitamura, R. (Ed.), *Town development by railway: the excitement of creating great public spaces* (鉄道で街づくり : 豊かな公共領域がつくる賑わい). (pp. 9 - 31). Kyoto: Gakugei Shuppansha.
- Drive and Stay Alive Inc. (2004). *Multi-country per capita fatality data for 2004*. Retrieved from <http://www.driveandstayalive.com/info%20section/statistics/stats-multicountry-percapita-2004.htm>
- Dunphy, R., Cervero, R., Dock, F., McAvey, M., & Porter, D. (2005). *Developing around transit: strategies and solutions that work*. Washington, DC: Urban Land Institute.
- Energy Conservation Centre Japan. (2002). *Energy conservation in the transportation sector*. Retrieved from http://www.eccj.or.jp/databook/2004-2005e/05_03.html
- Ensen Home's. (2009a). *Information on the rental market for apartments, condominiums, and single family homes for Jiyugaoka* (自由が丘駅の家賃アパート・マンション・一戸建ての家賃相場情報) . Retrieved February 19, 2008, from http://yachin.homes.co.jp/station_detail/ad11=13/rosen=882/eki=088205055/o=50h9m88dDonufQ/
- Ensen Home's. (2009b). *Information on the rental market for apartments, condominiums, and single family homes for Tama Plaza* (たまプラーザ駅の家賃アパート・マンション・一戸建ての家賃相場情報) . Retrieved February 19, 2008, from http://yachin.homes.co.jp/station_detail/ad11=14/rosen=885/eki=088505103/o=50h9m88dDonufQ/
- Fujita, K., & Hill, R. (1993). *Japanese cities in the world economy*. Philadelphia: Temple University Press.
- Fujita, K., & Hill, R. (1997). Together and equal: place stratification in Osaka. In Karan, P., & Stapleton, K. (Eds.), *The Japanese City*. (pp. 106-133). Lexington: The University Press of Kentucky.
- Fujita, K., & Hill, R. (2000). State restructuring and local power in Japan. *Urban Studies*, 37 (4), 373-90.
- Fukuoka International Association. (2006). *Japanese driver's licenses*. Retrieved from <http://www.rainbowfia.or.jp/living/e/14.html>

- Gilbert, R. & Perl, A. (2008). *Transport revolutions: moving people and freight without oil*. London: Earthscan Ltd.
- Golany, G., Hanaki, K., & Koide, O. (Eds.). (1998). *Japanese urban environment*. Oxford, UK: Elsevier Science Ltd.
- Goo Housing and Real Estate. (2008). *Tama Plaza station information (たまプラーザ駅の情報)*. Retrieved January 27, 2009, from <http://house.goo.ne.jp/chiiki/town/detail/2324150/index.html>
- Government of Western Australia, Department for Planning and Infrastructure. (2006). *Transit oriented development performance indicators*. Retrieved March 6, 2008 from <http://www.dpi.wa.gov.au/cityregionalplanning/15683.asp>
- Greater Vancouver Regional District (GVRD). (2003). *Population density in Greater Vancouver: 1991-2001*. Burnaby, BC: Policy and Planning Department, Greater Vancouver Regional District. Retrieved from <http://www.metrovancouver.org/about/publications/Pages/default.aspx>
- Hartgen, D., Ingalls, G., and Owens, T. (1993). *Public fear of crime and its role in public transit use*. Raleigh: University of North Carolina.
- Haseko Urbest Inc. (2007). *2007 ranking of most desirable towns (stations) (住んでみたい街(駅)2007)*. Retrieved from <http://www.haseko-urbest.com/press/pdf/20071126.pdf>
- Hayashi, Y. (1989). Issues in financing urban rail transit. *Transportation Research A*, 23A (1), 35-44.
- Hein, C. (2003). Change and continuity in postwar urban Japan. In Hein, C., Diefendorf, J., & Ishida, Y. (Eds.), *Rebuilding urban Japan after 1945*. (pp. 240-245). Chippenham, Wiltshire: Antony Rowe Ltd.
- Hess, D. & Almeida, T. (2007). Impact of proximity to light rail rapid transit on station-area property values in Buffalo, New York, *Urban Studies*, 44(5), 1041-1068.
- Hill, R. (2004). Comment on Fielding's 'Class and space: social segregation in Japanese cities', *Transactions of the Institute of British Geographers*, 29 (1), 86-87. doi: 10.1111/j.0020-2754.2004.0115b.x
- Himonya District Police Station. (2007). *Overview and history of the station (署の沿革・概況)*. Retrieved from <http://www.keishicho.metro.tokyo.jp/3/himonya/enkaku/enkaku.htm>

- Hiroo, I. (2003). Reconstruction Tokyo: The attempt to transform a metropolis. In Hein, C., Diefendorf, J., & Ishida, Y. (Eds.), *Rebuilding urban Japan after 1945*. (pp. 50-65). Chippenham, Wiltshire: Antony Rowe Ltd.
- Hirooka, H. (2000). The development of Tokyo's rail network. *Japan Railway and Transport Review*, 23, 22-30. Retrieved from www.jrtr.net/jrtr23/pdf/F22_Hirooka.pdf
- Hirsch, R., Bezdek, R. & Wendling, R. (2005). *Peaking of world oil production: impacts, mitigation, and risk management*. Pittsburgh: U.S. Department of Energy National Energy Technology Laboratory. Retrieved from http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf
- Home's Club. (2007). *Tokyoites choose the most desirable towns – 2007* (東京都民が選ぶ住みたい街2007). Retrieved from http://homesclub.nextgroup.jp/research/research/2007/post_43.php
- Hosono, T. (2004, August 20). *Tokyo number one, Kyoto number two for condominium parking charges* (分譲マンション駐車場料金、1位東京 2位は京都). Retrieved from <http://sumai.nikkei.co.jp/know/rank/index2004081905277d1.html>
- Ieda, H. (1995). Commuter railways: can congestion be relieved? *Japan Railway and Transport Review*, 3 (4), 8-15.
- Ieda, H. (2000). Practices (past & prospects) for Tokyo's public transport. In M. Bondada (Ed.), *Urban public transportation systems: Implementing efficient urban transit systems and enhancing transit usage* (pp. 634-642). Reston, Virginia: American Society of Civil Engineers.
- Ieda, H., Kanayama, Y., Ota, M., Yamazaki, T., & Okamura, T. (2001). How can the quality of rail services in Tokyo be further improved? *Transport Policy*, 8(2), 97-106).
- Iwai, H. (1998). Subway network development in Japanese cities. In Golany, G., Kanaki, K., & Koide, O. (Eds.), *Japanese Urban Environment*. (pp. 236-251). Oxford, UK: Elsevier Science Ltd.
- Jackson, M. (2008, October 30). Light rail can turn into money train. *Denver Post*. Retrieved from http://www.denverpost.com/news/ci_10850014
- Japan Automobile Manufacturers Association. (1995a). *Towards industrialization (1935-1945)*. Retrieved from <http://www.jama.org/about/industry2.htm>
- Japan Automobile Manufacturers Association. (1995b). *Promoting the automobile industry*. Retrieved from <http://www.jama.org/about/industry5.htm>

- Japan Road Association. (2005). *World road statistics (世界の道路統計)*. Retrieved from <http://www.road.or.jp/dl/statistics.html>
- Japanese Ministry of Land, Infrastructure, Transport, and Tourism. (2005). *Survey of regional flow of passengers and freight*. Retrieved from <http://toukei.mlit.go.jp/17/flow/index.pdf>
- Japanese Private Railway Association. (2006). *Railway fares as a share of household budget (家計に占める鉄道運賃)*. Retrieved from <http://www.mintetsu.or.jp/rail/plan/fare.html>
- Johnson, C., D'Andrea Tyson, L., & Zysman, J. (1989). *Politics and productivity: how Japan's development strategy works*. Cambridge, UK: Ballinger.
- Jones, M. (1984). *Working paper No. 75: passenger transport planning, management, and policy in Japan*. Proceedings of conference held at Wolfson College, Oxford 1983. Oxford, UK: Department of Town Planning, Oxford Polytechnic.
- JR East. (2004). *Annual report 2004*. Retrieved from www.jreast.co.jp/e/investor/ar/2004/pdf/ar2004_01.pdf
- Kageyama, Y. (2009, January 6). Car-free? In Japan, that's how a generation rolls. *The Associated Press*. Retrieved from <http://www.oregonlive.com/business/oregonian/index.ssf?/base/business/123121951587500.xml&coll=7>
- Kagoshima, K. (2002). *Station revitalization: the potential of designing spaces (駅再生・スペースデザインの可能性)*. Tokyo: Kagoshima Shuppankai.
- Kanagawa Prefectural Police. (2009). *Incidences of crime by police station (警察署別街頭犯罪等発生件数)*. Retrieved from <http://www.police.pref.kanagawa.jp/map/crime/html/mesd0801.htm>
- Karan, P. (1997). The city in Japan. In Karan, P., & Stapleton, K. (Eds.), *The Japanese City*. (pp. 12-39). Lexington: The University Press of Kentucky.
- Kato, S. (1996). Development of large cities and progress in railway transportation. *Japan Railway and Transport Review*, 4 (9), 44-48.
- Kawasaki, K. (1993, November). *Suburban culture is created by private railways: Jiyugaoka and along Tokyu rail lines (郊外文化は私鉄がつくる：自由が丘と東急沿線)*. *Tokyojin*, 74(11), 48-51.

- Keiei Jōhō Centre. (1971). *Tokyu Group's Development Strategy: an in-depth analysis of Tokyu's attempt at developing urban industry (MIC strategy series vol. 4)* (東急グループのデベロッパ戦略：都市産業へ挑戦するデベロッパー東急を徹底的に分析 (MIC 戦略シリーズ第4弾)). Tokyo: MIC.
- Kiriyama, H. (1997). An opinionated investigation of Tokyu Dentetsu (東急電鉄の独断的研究). *Tokyojin*, 78 (10), 56-65.
- Kishimoto, M. (1970). Characteristics of Japanese urbanization and metropolitanization. In Association of Japanese Geographers. (Ed.), *Japanese cities: A geographical approach*. (pp. 31-38). Tokyo: Association of Japanese Geographers.
- Koide, O., & Oyama, T. (1998). Social safety and security through urban design. In Golany, G., Kanaki, K., & Koide, O. (Eds.), *Japanese Urban Environment*. (pp. 75-94). Oxford, UK: Elsevier Science Ltd.
- Kurokawa, K. (1998). Metabolism, symbiosis, and culture of Japanese cities. In Golany, G., Kanaki, K., & Koide, O. (Eds.), *Japanese Urban Environment*. (pp. 5-24). Oxford, UK: Elsevier Science Ltd.
- Masai, Y. (1970). The contemporary Japanese townscape. In Association of Japanese Geographers. (Ed.), *Japanese cities: A geographical approach*. (pp. 97-108). Tokyo: Association of Japanese Geographers.
- Masai, Y. (1998). The human environments of Tokyo: past, present, and future. In Golany, G., Kanaki, K., & Koide, O. (Eds.), *Japanese Urban Environment*. (pp. 57-74). Oxford, UK: Elsevier Science Ltd.
- Masumoto, T., & Kosuda, H. (2005). *Understanding the railway industry* (よくわかる鉄道業界). Tokyo: Nippon Jitsugyo Publishing.
- Mather, C. (1997). Urban landscapes of Japan. In Karan, P., & Stapleton, K. (Eds.), *The Japanese City*. (pp. 40-55). Lexington: The University Press of Kentucky.
- May, J. (2008). Action stations. *Business Review Weekly*, 30 (7), 38-39.
- Meguro Ward. (2007). *Meguro ward handbook* (目黒区区勢要覧). Retrieved from <http://www.city.meguro.tokyo.jp/gyosei/koho/hakkobutsu/kuseiyoran/>
- Meguro Ward. (2008a). *Pay bicycle parking lots* (有料駐輪場). Retrieved from http://www.city.meguro.tokyo.jp/kurashi/jitensha_shohi/jitensha/yuryochurinjo/index.html

- Meguro Ward. (2008b). *Requirement for installing bicycle parking lots (自転車駐車場の設置)*. Retrieved from http://www.city.meguro.tokyo.jp/kurashi/jitensha_shohi/jitensha/churin/index.html
- Meguro Ward. (2009). *Population of Meguro ward this month (目黒区の今月の人口)*. Retrieved February 16, 2009, from http://www.city.meguro.tokyo.jp/gyosei/tokei/tokei/jinko/kongetsu_jinko/index.html
- Mieszkowski, K. (2008, October 23). Who says Americans won't ride mass transit? *Salon.com*. Retrieved from http://www.salon.com/env/feature/2008/10/23/mass_transit_america/
- Ministry of Internal Affairs and Communications Statistics Bureau. (2003). *Housing and land in Japan: 2003 statistical survey on housing and land (日本の住宅・土地：平成15年住宅・土地統計調査の解説)*. Retrieved from <http://www.stat.go.jp/data/jyutaku/2003/10.htm>
- Ministry of Land, Infrastructure, Transport, and Tourism. (1999). *Movement of people in cities (都市における人の動き)*. Tokyo: Railway Bureau of the Ministry of Land, Infrastructure. Retrieved from <http://www1.ibs.or.jp/cityplanning-info/zpt/zptno2.pdf>
- Ministry of Land, Infrastructure, Transport, and Tourism. (2002). *Motor vehicle inspection and registration guide – Q&A (自動車検査・登録ガイド・Q&A)*. Retrieved from <http://www.mlit.go.jp/jidosha/kensatoroku/question/index.htm>
- Ministry of Land, Infrastructure, Transport, and Tourism. (2005a). *Metropolitan area transportation census (平成17年大都市交通センサス)*. Retrieved from http://www.mlit.go.jp/sogoseisaku/kotu_census10/17siryu.html
- Ministry of Land, Infrastructure, Transport, and Tourism. (2005b). *Results of the measurement of evaluation indicators for comfort and security (快適性・安心性評価指標の計測結果一覧)*. Retrieved from http://www.mlit.go.jp/kisha/kisha06/01/011127_2_/02.pdf
- Ministry of Land, Infrastructure, Transport, and Tourism. (2008a). *Railway transportation summary (鉄道輸送の概要)*. Retrieved from <http://toukei.mlit.go.jp/10/annual/n1-1gaiyo.xls>
- Ministry of Land, Infrastructure, Transport, and Tourism (2008b). *2006 yearbook of railway statistics (鉄道統計年報—平成18年度)*. Tokyo: Railway Bureau of the Ministry of Land, Infrastructure.

- Miyata, M. (1995). *Tokyu*. Tokyo: Tokyu Hoikusha Books.
- Mizutani, F. (1994). *Japanese urban railways: a private-public comparison*. Gateshead, UK: Athenaeum Press Ltd.
- Mizutani, F. (2007). An assessment of the Japan Railway companies since privatization: performance, local rail service, and debts. *Transport Reviews*, 19(2), 117-139.
- Morichi, S. (2000). Socioeconomic characteristics, land use, and travel patterns in Tokyo Metropolitan Area. In M. Bondada (Ed.), *Urban public transportation systems: Implementing efficient urban transit systems and enhancing transit usage* (pp. 610-621). Reston, Virginia: American Society of Civil Engineers.
- MTR Corporation. (2008). *Summary Financial Report 2007*. Retrieved from http://www.mtr.com.hk/eng/investrelation/2007srpt_e/E206.pdf
- Muley, D., Bunker, J., & Ferreira, L. (2007). *Evaluating transit quality of service for transit oriented development (TOD)*. In Proceedings of the 30th Australasian Transport Research Forum (ATRF), Melbourne, Australia. Retrieved from http://eprints.qut.edu.au/archive/00009845/01/FP_Muley_49_TOD_&_QoS.pdf
- Muller, P. (2004). Transportation and urban form: stages in the spatial evolution of the American metropolis. In Hanson, S. & Giuliano, G. (Eds.), *The geography of urban transportation – 3rd*. (pp. 59-85). New York: The Guildford Press.
- Nagano Police. (2006). *Junkai renraku: connecting homes and koban / police substations (家庭と交番・駐在所を結ぶ「巡回連絡」)* Retrieved from <http://www.pref.nagano.jp/police/seian/koban/jyunkai.htm>
- Nagata, K. (2008, December 16). A highway system that ever exacts toll. *Japan Times*. Retrieved from <http://search.japantimes.co.jp/cgi-bin/nn20081216i1.html>
- Nationmaster.com. (2000a). *Total crimes per capita by country*. Retrieved from http://www.nationmaster.com/graph/cr_i_tot_cri_percap-crime-total-crimes-per-capita
- Nationmaster.com. (2000b). *Murders per capita by country*. Retrieved from http://www.nationmaster.com/graph/cr_i_mur_percap-crime-murders-per-capita
- Nationmaster.com. (2000c). *Police per capita by country*. Retrieved from http://www.nationmaster.com/graph/cr_i_pol_percap-crime-police-per-capita

- O-Heya Sagashi Tatsujin. (2009). *Determine distance from a train station (駅からの距離を決める)*. Retrieved from <http://www.heyasagase.com/guide/joken/step03.html>
- Ohland, G., & Poticha, S. (2007). *Street smart: streetcars and cities in the 21st century*. Oakland: Reconnecting America.
- Organization for Economic Cooperation and Development (OECD). (2006). *OECD health data 2006*. Retrieved from <http://www.oecd.org/dataoecd/27/6/36972440.pdf>
- Oshima, K. (1996). Denenchofu: building the garden city in Japan. *The Journal of the Society of Architectural Historians*, 55(2), 140-151.
- Perl, A. (2002). *New departures: rethinking rail passenger policy in the twenty-first century*. Lexington, Kentucky: The University Press of Kentucky.
- Post, R. (2007). *Urban mass transit: the life story of a technology*. Westport, CT: Greenwood Press.
- Pravda. (2008, August 21). *Japanese women can now travel in women-only train cars to avoid groping*. Retrieved from <http://english.pravda.ru/news/society/21-08-2006/84007-groping-0>
- Premius, H. & Konings, R. (2001). Light rail in urban regions: what Dutch policymakers could learn from experiences in France, Germany, and Japan. *Journal of Transport Geography*, 9, 187-198.
- Project for Public Spaces. (2008). *Zurich, Switzerland: how a citizen uprising launched one of the world's great transit systems*. Retrieved February 2, 2009, from http://www.pps.org/info/newsletter/feb08/zurich_switzerland
- Pucher, J. (2004). Public transportation. In Hanson, S., & Giuliano, G. (Eds.), *The geography of urban transportation – 3rd edition*. (pp. 199-236). New York: The Guildford Press.
- Pucher, J. & Dijkstra, L. (2000). Making walking and cycling safer: lessons from Europe. *Transportation Quarterly*, 54(3), 25-50.
- Pucher, J. & Renne, J. (2003). Socioeconomics of urban travel: evidence from the 2001 NHTS. *Transportation Quarterly*, 57(3), 49-77.
- Railway Town Development Conference. (2004). *What should be done? The future of railways: to revitalize communities. (どうする？鉄道の未来：地域を活性化するために)*. Tokyo: Ryokufu Shuppan.

- S-Park. (2008). *Tokyo parking information site* (都内駐車場案内サイト). Retrieved from <http://www.s-park.jp/>
- Schmitz, J. (2009, January 12). Can transit grow neighbourhoods? *Pittsburgh Post-Gazette*. Retrieved from <http://www.post-gazette.com/pg/09012/941226-147.stm>
- Sekiguchi, M. (2006). JR East's approach to universal design of railway stations. *Japan Railway and Transport Review* 45, 9-11
- Sekita, K. (2008). *Town and station – 80 years of images: 80th anniversary photo book of the Toyoko, Ikegami, and Oimachi lines* (街と駅80年の情景：東横線・池上線・大井町線80周年記念フォトブック). Tokyo: Tokyu Agency Inc.
- Setagaya Ward. (2008). *Record of population and households by area*. Retrieved January 20, 2009, from http://www.city.setagaya.tokyo.jp/toukei/rireki/rireki_0811/district.html
- Setagaya Ward. (2009a). *Information on bicycle parking around the station* (駅周辺駐車場案内). Retrieved from <http://www.city.setagaya.tokyo.jp/030/d00009964.html>
- Setagaya Ward. (2009b). *This month's population pick up* (今月の人口ピックアップ). Retrieved February 15, 2009, from <http://www.city.setagaya.tokyo.jp/toukei/>
- Shimizu, K. (1970). The problems of Japanese metropolization, in Japanese Cities: A Geographical Approach. In Association of Japanese Geographers. (Ed.), *Japanese cities: A geographical approach*. (pp. 221-226). Tokyo: Association of Japanese Geographers.
- Shoji, K. (2001). Lessons from Japanese experiences of roles of public and private sectors in urban transport. *Japan Railway and Transport Review*, 29, 12-19.
- Simian, B.B. (1989). Land use planning in Japan. *Planner*, 75(3), 13-16.
- Sorensen, A. (1999). Conflict, consensus, or consent: implications of Japanese land readjustment practice for developing countries. *Habitat International*, 24(1), 51-73.
- Statistics Canada. (2008a). *Canada's population estimates: third quarter 2008*. Retrieved February 3, 2009, from <http://www.statcan.gc.ca/daily-quotidien/081219/dq081219b-eng.htm>

- Statistics Canada. (2008b). *Employed labour force by mode of transportation to work, by province and territory (2006 census)*. Retrieved November 10, 2008, from <http://www40.statcan.gc.ca/l01/cst01/labor42a-eng.htm>
- Tabb, K. (1995). *The postwar Japanese system: cultural economy and economic transformation*. New York: Oxford University Press.
- Tabuchi, H. (2009, February 21). When consumers cut back: a lesson from Japan. *New York Times*. Retrieved from http://www.nytimes.com/2009/02/22/business/worldbusiness/22japan.html?_r=1&em
- Tamapura Scope. (2007). *Study of Tama Plaza's walking sphere for the "Beautiful Forest" new town (たまプラーザ徒歩圏の新しい街 "美しの森" 大研究)*. Retrieved from <http://www.tamapla.jp/wadai/utsukusinomori.html>
- Terada, K. (1994). Railways in Japan – Public and private sectors. *Japan Railway & Transport Review*, 27, 48-55. Retrieved from http://www.jrtr.net/jrtr27/s48_ter.html
- Thompson, G., & Matoff, T. (2003). Keeping up with the Joneses: radial vs. multidestinational transit in decentralizing regions. *Journal of the American Planning Association*, 69, 296-312.
- Tokyo Metropolitan Government. (2006). *Condition of Tokyo parks and green space*. Retrieved from www.toukei.metro.tokyo.jp/ssihyou/ss06qd0208.pdf
- Tokyo Metropolitan Government. (2008a). *Map of Tokyo's wards, cities, municipalities, and villages. (都内区市町村マップ)* http://www.metro.tokyo.jp/PROFILE/map_to.htm
- Tokyo Metropolitan Government. (2008b). *Area index of Tokyo statistics. (東京都の統計・分野索引)*. Retrieved December 3, 2008 from: <http://www.toukei.metro.tokyo.jp/homepage/bunya.htm#11>
- Tokyo Metropolitan Government. (2009). *Estimate of Tokyo's population for 2009*. Retrieved January 16, 2009 from <http://www.toukei.metro.tokyo.jp/jsuikai/2009/js090f0000.pdf>
- Tokyo Metropolitan Police Department. (2007a). *Number of crimes recorded in the 23 wards (地区別刑法犯認知件数・23区)*. Retrieved from <http://www.keishicho.metro.tokyo.jp/toukei/keiho/pdf/ken.pdf>

- Tokyo Metropolitan Police Department. (2007b). *Crime information map (犯罪発生マップ)*. Retrieved from <http://www.keishicho.metro.tokyo.jp/toukei/johomap/johomap.htm>
- Tokyo Metropolitan Police Department. (2008). *Traffic accidents resulting in death in the Tokyo metropolitan area (東京都内の交通人身事故発生状況)*. Retrieved from http://www.keishicho.metro.tokyo.jp/kotu/roadplan/2rin_jiko.htm
- Tokyo Metropolitan Police Department. (2009a). *Traffic accidents resulting in injury or death in the Tokyo metropolitan area in 2008 (東京都内の交通死亡事故発生状況)*. Retrieved from <http://www.keishicho.metro.tokyo.jp/toukei/bunsyo/toukei19/pdf/kt19d010.pdf>
- Tokyo Metropolitan Police Department. (2009b). *Traffic accidents by area in 2008 (交通事故発生状況)*. Retrieved from <http://www.keishicho.metro.tokyo.jp/toukei/jiko/data/h21.pdf>
- Tokyo Metropolitan Police Department. (2009c). *Traffic accident map (交通事故発生マップ)*. Retrieved from <http://www.keishicho.metro.tokyo.jp/toukei/jikomap/jikomap.htm>
- Tokyu Bus Corporation. (2009a). *Jiyugaoka station timetable. (自由が丘駅時刻表)*. Retrieved from <http://www.tokyubus.co.jp/jikoku090301/dia/fareguide/FARE647401.pdf>
- Tokyu Bus Corporation. (2009b). *Tama Plaza station timetable. (たまプラーザ駅時刻表)*. Retrieved from http://www.tokyubus.co.jp/jikoku/dia/cgi/search_route.cgi?stcode=1780101
- Tokyu Corporation. (2007a). *2007/2008 Tokyu Corporation (2007/2008 東急電鉄)*. Tokyo: Tokyu Corporation, Office of the President Public Relations Department.
- Tokyu Corporation. (2007b). *Tokyu Corporation – housing operations (東急電鉄・住宅事業)*. Retrieved from http://www.tokyu.co.jp/contents_index/guide/zyutaku.html
- Tokyu Corporation. (2008). Personal communication with station employee.
- Tokyu Corporation. (2009). *Timetable by station (各駅時刻表)*. Retrieved from <http://www.Tokyu.co.jp/railway/menu/jikoku.html>

- Tokyu Land Corporation. (2007). *Land price distribution map of Metro Tokyo – 2007 (平成19年地価分布図・首都圏)*. Retrieved from <http://www.tokyu-land.co.jp/map/chikabunpu/h19s/s-chika.html>
- Transport Canada. (2007). *2005 motor vehicle collision traffic statistics*. Retrieved from <http://www.tc.gc.ca/mediaroom/releases/nat/2007/07-h017e.htm>
- Transportation Association of Canada. (1996). *Urban transportation indicators in eight Canadian urban areas*. Ottawa, Canada: TAC.
- Transportation Association of Canada. (2002). *Innovations in financing urban transportation*. Ottawa, Canada: TAC.
- Transportation Association Council of Canada. (2006). *Urban transportation indicators survey: advancing the state of information on Canada's urban areas*. TAC Briefing, February 2005.
- Transportation Research Board (2003). *Transit capacity and quality of service manual, 2nd edition*. Retrieved from <http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp100/part%203.pdf>
- Transportation Research Board. (2005). *Transit-oriented development: developing a strategy to measure success*. Retrieved April 2, 2008, from: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_294.pdf
- Tsuru, M. (2008). Tokyu Kyuko Dentetsu: Looking at large scale upgrades (東京急行電鉄：大規模改良を見る). *Tetsudo Journal*, 498 (4), 21-41.
- Tucker, D. (2003). Learning from Dairen, learning from Shinkyō: Japanese colonial city planning and postwar reconstruction. In Hein, C., Diefendorf, J., & Ishida, Y. (Eds.), *Rebuilding urban Japan after 1945*. (pp. 156-187). Chippenham, Wiltshire: Antony Rowe Ltd.
- United Nations. (1994). *Municipal land management in Asia: a comparative study*. Retrieved from http://www.unescap.org/huset/m_land/chapter10a.htm
- United Nations. (2007). *World urbanization prospects: the 2007 revision population database*. Retrieved February 3, 2009, from <http://esa.un.org/unup/p2k0data.asp>
- U.S. Census Bureau. (2000). *United States -- Places and (in selected states) county subdivisions with 50,000 or more population; and for Puerto Rico*. Retrieved from http://factfinder.census.gov/servlet/GCTTable?_bm=y&-geo_id=&-ds_name=DEC_2000_SF1_U&-_lang=en&-mt_name=DEC_2000_SF1_U_GCTPH1R_US13S&-format=US-13

- Vasquez, E. & Mayer, J. (2009, February 18). The MTA as stealth development agency. *Planetizen*. Retrieved from <http://www.planetizen.com/node/37453>
- Victoria Transport Policy Institute (2006). *Fuel price, consumption, travel and risk*. Retrieved from <http://www.vtpi.org/tdm/tdm80.htm>
- Vuchic, V. (2005). *Urban transit: Operations, planning, and economics*. Hoboken, New Jersey: John Wiley & Sons.
- Weinberger, R. (2001). *Commercial rents and transportation improvements: case of Santa Clara County's light rail*. Cambridge, MA: Lincoln Institute of Land Policy.
- Yajima, T. (2000). Urban public transportation system and its operation and use by people in Tokyo. In M. Bondada (Ed.), *Urban public transportation systems: Implementing efficient urban transit systems and enhancing transit usage* (pp. 622-633). Reston, Virginia: American Society of Civil Engineers.
- Yamaga, H. (2000). The impacts of fare reimbursement and congestion charge on housing rents: the case of a commuter line in Tokyo. *Review of Urban & Regional Development Studies*, 12(3), 200-212.
- Yasunobu, A. (2006). Examination of building heights for various building types in Tokyo 23 wards. *Transactions of the Society of Heating, Air Conditioning, and Sanitary Engineers of Japan*, 115, 51-54.