Station area developments in Tokyo and what the Randstad can learn from it

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In the previous chapter the development patterns of 99 station areas in the Tokyo Metropolitan Area were explored by analyzing their respective node and place values. The correlation analysis revealed that certain combinations of transport (the node) and land use (the place) factors had a stronger influence on structuring station area redevelopments than others. The highest correlation, and thus the strongest influence on structuring station area developments in Tokyo, was found by comparing the node values “proximity to CBD” and “number of train connections” with the place value “workforce”. In this chapter the development patterns as identified by the node-place model are further analysed by focusing on railway corridors.
Why railway corridors? Various studies (e.g. Bertolini, 2007; Cervero, 1998; Curtis et al., 2009; Dittmar & Ohland, 2004; Fillion & McSpurren, 2007) have pointed out that a successful integration of transport and land use requires plans covering the entire metropolitan region that are consistent over a long period of time. The importance of the region is further underlined by the fact that, at least in the Netherlands, the majority of our daily activity and mobility patterns take place at a regional level (Ruimtelijk Planbureau, 2006). Consequently, an approach is needed which is able to coordinate the daily activity and mobility patterns at this level. In this thesis it is hypothesized that a focus on railway corridors offers the best chance for this. There are various reasons for this (Bertolini & Rietveld, 2008). First, within a railway corridor origin (residential areas) and destination (working and leisure areas) locations can be developed in a coherent way. This allows a developer to design an integral strategy for the whole area aimed at specific target groups. Second, a focus on the railway corridor allows for a coordination of plans between different station areas. In this way destructive competition between station areas can be avoided and instead synergies between them can be promoted. In a similar way, a focus on the railway corridor can stimulate better transfer options between different modes of transport. And last but not least, a focus on the railway corridor makes it possible to utilize public transport in a more efficient way by focusing on redevelopments that generate off-peak travel or bi-directional traffic flows.

In this thesis a railway corridor is defined as a railway line operating on a regional level including the land surrounding the stations of that line. It is realized, however, that railway corridors operate on different levels (e.g. national, international, and local level). Moreover, railway corridors are part of a network, and consequently the focus should be on the network rather than on the corridors for coordinating transport and land use development at the regional level. The reason that this thesis focuses on railway corridors is purely a pragmatic one. Tokyo has an extensive metropolitan railway system which is owned and operated by several private companies, rather than just one. Each private railway company owns and operates a particular part of the network for which they have obtained exclusive franchises. Consequently, the main focus of each company is on the development of its own ‘railway territories’, rather than on investments elsewhere in the railway system. However, this does not mean that private railway companies do not cooperate with each other. For issues covering the whole metropolitan region, i.e. travel fare, safety, Pasmo (a smart card for public transport in Tokyo) and railway policies, a so-called ‘Association of Private Railways’ exists in which private railway companies are united. Furthermore, many private railway operators offer through-services with lines operated by mutual direct train services with other private railway companies thereby reducing the number of transfers and thus increasing the convenience for its passengers. This has prevented regional interests from being overlooked by subregional/local interests in Tokyo.

The aim of this chapter is to explore a number of questions focused on railway corridors:
Chapter 6 - Corridor studies

1. Does a focus on railway corridor allow for locations to be planned and developed in a coherent way as Bertolini & Rietveld (2008) argue?
2. Does a focus on railway corridors result in synergies between station areas, or in other words, is it a useful tool for preventing competition between station areas as is argued?
3. Does a focus on railway corridors allow for a better coordination between different modes of transport?
4. Does a focus on railway corridors result in off-peak travel and bi-directional traffic flows as Bertolini & Rietveld (2008) argue?

The findings from these questions should indicate whether or not a railway corridor is an appropriate level for coordinating transport and land use developments at the regional level.

With the above questions in mind a number of railway corridors in Tokyo will be analyzed in the next paragraphs. In the conclusion (6.4) an answer will be given to the questions posed above.

6.1 Analyzing railway corridors in Tokyo

In Tokyo the railway corridor plays an important role in people’s daily activity patterns. Shopping, leisure, amusement, universities, residences and offices can all be found along the same railway corridor. These activities are made accessible by offering a large variety of train services within a railway corridor ranging from local, semi-local, express, rapid express and limited express trains\(^{33}\) that run at high frequencies. In Japan railway lines are operated in exclusive franchises by private railway companies of which the majority also owns the railway lines (see chapter 4). In addition, they operate buses which serve to complement the railway network or to provide feeder services. Private railway companies also possess considerable amounts of land much of which tends to be concentrated along their own railway lines. This has enabled them, as is demonstrated later on in this chapter, to develop an integral area strategy in which generating synergies between their core businesses of transportation, real estate and retail play a pivotal role. High passenger numbers and profitable transportation services have proven that this model seems to work quite well in Japan.

\(^{33}\) The difference between these service levels is that local trains stop at each station, while limited express trains/services only stop at a limited number of stations.
Railway corridors are not only developed by private railway companies. In fact, several models exist. For example, in the case of the development of Tama New Town (a large town built in the west of Tokyo in the 1960s) the railways were owned and operated by private railway companies, while the surrounding land was mainly developed by public and semi-public organizations (Kiuchi & Inouchi, 1976; Tanabe, 1978). Another yet more recent example is the Tsukuba Express line (Chorus, 2008). This commuter line commenced its services in 2005 and is owned and operated by a third sector railway company in which local governments and some private corporations have invested. As for the development of the land along the Tsukuba Express railway line: 20 projects are underway of which 11 are being developed by local governments, 7 by the urban renaissance agency (a national semi-public housing corporation), 1 by a local public housing corporation, and 1 by a land owners association (Urban Renaissance Agency, 2009).

In this chapter the focus will lie on railway corridors that are owned (i.e. the railways and surrounding land) and operated by private railway companies. Two railway corridors will be analysed in this chapter. They are:

1. the Toyoko line between Shibuya and Yokohama, owned and operated by Tokyu Corporation
2. the Odawara line between Shin-Yurigaoka and Shinjuku, owned and operated by Odakyu Corporation

These railway corridors were not randomly chosen, but closely relate to the station areas analysed in the node-place model in the previous chapter. Railway corridors were selected that contained at least five of these station areas in order to get a representative image of the corridor involved. Furthermore, the railway line needed to operate on the regional level in order to be in line with the definition used for a railway corridor in this research. For Tokyo this meant that subway lines were excluded as they in general, when not taking into account their through-connections, operate on a local (inner-city) level. The same applies to the circular Yamanote line. Although the railway corridors owned and operated by JR East would have matched both criteria, they were not analysed here. This is because JR East is a relatively young private railway company and as such it is lagging behind regarding its business diversification. In addition, JR East owns hardly any land around its stations (see also chapter 4). As such its situation deviates too much from that of other private railway operators, which makes it rather difficult to compare its development patterns with that of the other private railway operators.

The development patterns of the two railway corridors were explored in two different ways:

1. By looking at how the development patterns relate to the position of a station in the node-place model. This was done using the used in chapter 6 ‘Proximity to CBD and number of train connections versus workforce’ model identified in chapter 5 as having the highest influence on the development of station areas.
2. By looking at how the development patterns relate to the position of a station in the railway corridor.

The two railway corridors were analysed by looking at 1) corridor morphology, 2) assigned densities and 3) functional diversity.

1. **Corridor morphology**: provides the context necessary for explaining differences in development patterns between station areas. Corridor morphology is analysed by calculating for each station its travel time and distance to the nearest sub-centre, its respective passenger numbers and the number and type of services offered at each station. The passenger numbers do not include the passengers transferring from other lines as these passengers are not considered users of the station area. Travel time and distance are related to a station's proximity to the nearest sub-centre, as passenger flows tend to be larger in the direction to the sub-centre than away from it. Especially in Tokyo where most jobs are still heavily concentrated in the centre this seems to be the case.

2. **Assigned densities**: density is considered one of the factors stimulating public transit usage (e.g. Cervero & Kockelman, 1997). In general, stations with higher densities have higher passenger numbers. This certainly applies to Tokyo. Furthermore, assigned density is considered an important means for attracting new developments in Japan. Each land use zone is assigned with a particular density, i.e. a floor area ratio (FAR), which represents the presumed development potential. Densities are assigned by the local government and its exact value is determined by the City Planning Law. Interestingly, station areas in Japan are assigned with higher values than other areas. Local governments seem thus to regard station areas as having a higher development potential than other areas in Japan. However, a presumed development potential is not the only reason for assigning station areas with higher density values. In Tokyo, it is also seen as a means to alleviate overcrowding of the city centre, to relieve traffic congestion, and to bring home and workplaces closer together (TMG, 1998; 2002). To resolve these problems the Tokyo Metropolitan Government (TMG) has designated several centres outside of the central area where businesses and commercial functions are to be decentralized. Since the 1970s such policies have consistently held place in plans to solve Tokyo’s problem of over-concentration in the CBD (Sorensen, 2001).

Figure 6-1 illustrates that it is not so easy to determine an assigned density per station as different density levels can be found within one station area. In this research the density levels assigned to the areas directly bordering a station have been used, as these areas are considered to have the highest development potential and thus the highest FAR-values.
3. **Functional diversity**: just like density, diversity is considered to be positively related to public transport usage (e.g. Calthorpe, 1993; Cervero, 1996; Ditmar & Ohland, 2004). A station area characterized by a diverse and dense environment is not only able to attract more passengers, but it is also able to spread them more evenly during the day. Functional diversity is analyzed by looking at the distribution of workers over the four economic clusters: 1) services and administration 2) retail, hotel and catering 3) industry & distribution and 4) education, health and culture (also used in chapter 5). In addition, the number of residents is included in this analysis. In both cases the number of workers and population is determined within a radius of 700 metres around the station. Together, the workers and the residents are considered to represent the users of the station area.

In the next paragraphs the Toyoko line (6.2) and the Odawara line (6.3) will be analyzed following the approach outlined above. Each paragraph starts with some facts and figures about the private railway company involved in operating the line and outlines its business strategy. This information provides the context necessary for understanding the role of the private railway company in developing a railway corridor. Most of the information was derived from the annual reports of the private railway companies concerned and the interviews that were held with some of the railway officials.
6.2 The Toyoko line

The Toyoko line is owned and operated by Tokyu Corporation, one of the major private railway companies operating in the Tokyo metropolitan area with its headquarters located in Shibuya. Tokyu Corporation owns and operates seven railway lines with a total length of 99.5 kilometres in the area to the southwest of the sub-centre of Shibuya. Additionally, it operates two lines which are owned by another railway company. Besides railway lines, Tokyu Corporation operates several bus routes acting as feeders for its railway network.

Figure 6-2 Regional map of Tokyu railway lines (red lines on the map)

Tokyu Corporation is involved in business areas such as retail (chain stores, department stores and shopping centres), real estate (sales, leasing and management), hotels, leisure and services (golf courts, tennis courts, swimming pools and other sports facilities), and other services (car rental, travel agencies, advertising, and cable television services). These activities are either carried out by Tokyu Corporation or by affiliated companies. Most of the retail facilities are located along Tokyu railway lines, and the majority of them are concentrated within a 10 kilometre radius of Tokyo station (see figure 6-3). Major office properties owned by the company show a somewhat similar pattern; however, nearly half of them are located in areas not
served by Tokyu railway lines. Currently new office properties are planned at a larger distance from Tokyo station, for example around the station of Futako Tamagawa (see figure 6-3). This could be seen as a means to reduce congestion by promoting reverse transportation, i.e. away from Shibuya station and thus away from central Tokyo.

Tokyu Corporation is considered one of the most successful companies in integrating rail and real estate development (Cervero, 1998; Padeco, 2000). Perhaps this is best illustrated by the development of Tama Garden City (a new town of 50 square kilometres and 600,000 inhabitants) in which Tokyu Corporation played a leading role.

Figure 6-3  Commercial facilities along Tokyu railway lines

The group management policy of Tokyu Corporation is formulated in a medium-term management plan. The basic policy adhered to in the current management plan (2008-2011), and in previous versions as well, focuses on achieving growth through a strong collaboration between its three core business areas of transportation, real estate, and retail. This, it is assumed, will generate greater synergies among these businesses and consequently will increase growth. Three growth strategies have been formulated that promote a strong collaboration, and thus greater synergies, among its core business areas (Tokyu Corporation, 2005 2008):
1) **A more focused area strategy:**

The territory served by Tokyu railway lines is classified into four areas. Each area is analysed according to the characteristics of its residents and passengers (e.g. age structure, income, population growth, consumption, expenditure). Accordingly, a specific business strategy is drawn up for the area. The Toyoko line is considered one of these areas. Tokyu Corporation considers stations and towns as ‘peas’ connected to each other via a railway line, while the area served by a railway line (the origin locations) is seen as the ‘bean’. They refer to this as the ‘PEAs strategy’ (see figure 6-4).

![Figure 6-4 Area strategy of Tokyu Corporation](image)

**Source:** Tokyu Corporation, 2005.

2) **Development of focal points:**

Key locations around the major stations belonging to Tokyu Corporation are developed according to the area strategies. Currently development plans are underway for Shibuya station, Futako Tamagawa station and Tama Plaza station (Tokyu Corporation, 2010). Characteristically, these plans focus on a wide range of activities and facilities with which they hope to exploit synergies among their core businesses (transport, real estate, and retail) such as increasing day-time passenger volume, attracting new residents and promoting consumption. In contrast to Shibuya station, Futako Tamagawa and Tama Plaza station are situated outside the centre of Tokyo; their development should be seen as a way to stimulate daytime and reverse transportation (i.e. away from Shibuya station) in line with government policies to decentralize business and commercial facilities away from the city centre. In addition, the development of all three locations has been triggered by government measures. For example, Shibuya station has been designated by the national government as ‘priority development area’ and as such is able to enjoy financial and procedural benefits (see chapter 7). Futako Tamagawa station is one of the centres designated by the TMG where businesses and commercial functions need to be decentralized. For similar reasons Tama Plaza station is designated by the Yokohama city government as an important sub-centre. And last but not least, these redevelopment plans all concern outdated land uses and buildings largely owned by Tokyu Corporation.
3) Promotion of retail-related operations:
Retail is considered the third core business of Tokyu Corporation, after transportation and real estate. By promoting retail-related businesses such as department stores, chain stores, shopping centres and other services Tokyu Corporation hopes to increase the attractiveness of the lifestyles of residents living along their railway lines. In addition, Tokyu Corporation is encouraging differentiation and individualization among its retail facilities (Tokyu Corporation, 2006). For this it has developed a retail refinement plan in which stations, i.e. the commercial facilities along a specific number of stations, are divided into different retail types. Each type serves a particular market (e.g. neighbourhood-community, neighbourhood-regional, regional, and super-regional) and focuses on specific facilities. In line with the retail types the existing and planned commercial facilities along a specific number of stations are to be redefined. In this way Tokyu Corporation hopes to generate synergy among its commercial facilities, and to create a more attractive living environment around its railway lines.

Tokyu Corporation aims to play a role as a life-style design supporter oriented towards maintaining and increasing the vitality of communities served by its own railway lines. Private railway operators are, as was illustrated above, involved in several side-businesses. They do this on the one hand to make their railway operations more efficient (i.e. generate stable ridership) and on the other hand to increase their profit margins (see chapter 4).

One indicator for determining whether railway operations are working efficiently is the number of passengers carried. As figure 6-5 illustrates, the number of passengers using the railway lines of Tokyu Corporation has fluctuated between 1989-2011. However, since the year 2000 the number of passengers has continuously increased. This increase in passenger numbers can to some extent be attributed to the network enhancements (e.g. providing through services with railway lines of other private railway operators) and large-scale improvement works (e.g. extension and quadrupling of existing railway lines) that Tokyu Corporation has carried out.

Figure 6-5 Annual passengers carried between fiscal year 1989-2010 (in millions)

In addition, the Tokyu Corporation has managed to attract passengers to its railway lines through non-transportation investments. As for example figure 6-6a illustrates, the number of passengers at Minami-Machida station has increased considerably since 2000 when a new shopping mall was opened in the vicinity of the station. Especially the share of non-commuters (the blue bar in figure 6-6a) has gone up which is a clear indication that this station is increasingly being used after peak hours. In addition, its retail sales have also gone up (see figure 6-6b).

Figure 6-6a/b  Number of passengers (left) and history of sales (right) at Minami Machida station


6.2.1  Corridor morphology

Facts and figures of the Toyoko line

<table>
<thead>
<tr>
<th>Facts</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length in kilometres:</td>
<td>24.2</td>
</tr>
<tr>
<td>Number of stations:</td>
<td>21</td>
</tr>
<tr>
<td>Year opened:</td>
<td>1926</td>
</tr>
<tr>
<td>Number of passengers per day (excluding transfer):</td>
<td>1.36 million</td>
</tr>
<tr>
<td>Travel time between Shibuya and Yokohama:</td>
<td>29 minutes (by rapid express)</td>
</tr>
<tr>
<td>Maximum speed:</td>
<td>110 km/h</td>
</tr>
<tr>
<td>Congestion ratio:</td>
<td>172%$^{34}$</td>
</tr>
</tbody>
</table>

In chapter 5 the development dynamics of 99 station areas were analysed with the help of the node-place model. Eight of these stations are located on the Toyoko line and are therefore a part of this corridor analysis.

$^{34}$ Congestion ratio is the ratio of the number of passengers compared to the train capacity. A capacity of 100% means that 3 persons 'stand' in 1 m2 of floor space (Ieda, 1995). The congestion ratio of 172% concerns a section of the Toyoko line (i.e.Yutenji-Naka Meguro).
As was mentioned before, the corridor morphology is analyzed by travel time and distance of stations to the nearest sub-centre, passenger numbers, and the type and number of services offered at each station (see figures 6-8a through 6-8c). Determining the travel time to the nearest sub-centre is more complicated for the Toyoko line as this line actually has two sub-centres, i.e. Shibuya and Yokohama. Shibuya station has been chosen as a point of reference, as the largest daily passenger flows are expected to go in this direction.

Figure 6-8a  Distance in kilometres and travel time to Shibuya

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance</th>
<th>Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shibuya</td>
<td>0.0 km</td>
<td>0 min.</td>
</tr>
<tr>
<td>Naka Meguro</td>
<td>2.2 km</td>
<td>4 min.</td>
</tr>
<tr>
<td>Jiyugaoka</td>
<td>7.0 km</td>
<td>9 min.</td>
</tr>
<tr>
<td>Den en Chofu</td>
<td>8.2 km</td>
<td>11 min.</td>
</tr>
<tr>
<td>Tamagawa</td>
<td>9.0 km</td>
<td>13 min.</td>
</tr>
<tr>
<td>Musashi Kosugi</td>
<td>10.8 km</td>
<td>15 min.</td>
</tr>
<tr>
<td>Kikuna</td>
<td>18.8 km</td>
<td>23 min.</td>
</tr>
<tr>
<td>Yokohama</td>
<td>24.2 km</td>
<td>29 min.</td>
</tr>
</tbody>
</table>

Figure 6-8b  Daily passenger numbers excluding transfer (x1000)

<table>
<thead>
<tr>
<th>Location</th>
<th>Passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shibuya</td>
<td>286</td>
</tr>
<tr>
<td>Naka Meguro</td>
<td>51</td>
</tr>
<tr>
<td>Jiyugaoka</td>
<td>82</td>
</tr>
<tr>
<td>Den en Chofu</td>
<td>24</td>
</tr>
<tr>
<td>Tamagawa</td>
<td>10</td>
</tr>
<tr>
<td>Musashi Kosugi</td>
<td>57</td>
</tr>
<tr>
<td>Kikuna</td>
<td>104</td>
</tr>
<tr>
<td>Yokohama</td>
<td>136</td>
</tr>
</tbody>
</table>

Figure 6-8c  Number and type of train service (R= rapid express; L= local express)

<table>
<thead>
<tr>
<th>Location</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shibuya</td>
<td>R</td>
</tr>
<tr>
<td>Naka Meguro</td>
<td>R</td>
</tr>
<tr>
<td>Jiyugaoka</td>
<td>R</td>
</tr>
<tr>
<td>Den en Chofu</td>
<td>L</td>
</tr>
<tr>
<td>Tamagawa</td>
<td>L</td>
</tr>
<tr>
<td>Musashi Kosugi</td>
<td>R</td>
</tr>
<tr>
<td>Kikuna</td>
<td>R</td>
</tr>
<tr>
<td>Yokohama</td>
<td>R</td>
</tr>
</tbody>
</table>

35 People getting on and off the train.
6.2.2 **Assigned densities**

With the help of the websites of Yokohama City and the Tokyo Metropolitan Government the designated FAR-values for the areas directly bordering the stations were found. Accordingly, these values are related to the position each station has in the node place model and in the railway corridor (see figures 6-9 and 6-10).

![Assigned densities and their position in the node place model](image)

**Figure 6-9**

**Assigned densities and their position in the node place model**

![Assigned densities and their position in the railway corridor (%)](image)

**Figure 6-10**

**Assigned densities and their position in the railway corridor (%)**

Figure 6-9 illustrates that a certain hierarchical pattern can be distinguished when plotting the densities in the node-place model. In general the following applies: the higher the position of a station in the node-place model, the higher the density of the areas directly bordering the stations. Translated to the node-place criteria used in this analysis this means that stations with a large workforce, a high number of train connections, and in close proximity to the CBD tend to get higher assigned densities than stations where this is not the case. Jiyugaoka station is an exception as this station has a high density level compared to its position in the node-place model. An explanation for this is that Jiyugaoka station is one of the designated sub centres outside the city centre that is designed to draw developments away from the city centre. As such it has been awarded a higher density level. In addition to its sub centre status, the position of Jiyugaoka station in the railway corridor (see figure 6-10) can also be seen as a means to increase reverse transportation flows (i.e. away from Shibuya station) and consequently achieve a more efficient train operation.
In figure 6-11 the assigned density levels of the 21 stations belonging to the Toyoko line are illustrated. This figure clearly shows that density levels differ considerably within a railway corridor. In general, the highest densities are assigned to the sub centres, which in the case of the Toyoko line are Shibuya and Yokohama station. The intermediate stations show a relatively low and similar density level. However, interestingly there are also some stations that clearly stand out in comparison to their neighbouring stations such as Jiyugaoka and Musashi Kosugi station (see the arrows in figure 6-11). Both stations are considered important sub-regional centres for decentralizing businesses and commercial facilities outside the CBD of Tokyo, and in the case of Musashi Kosugi outside the centre of Kawasaki, which is highlighted by the fact that the TMG and the city of Kawasaki have assigned them higher density values.

6.2.3 Functional diversity

Based on a GIS-computation (Geographical Information Systems) the numbers of employees and residents within 700 metres of the selected stations have been calculated. The figure below illustrates how these data are distributed within a station area when considering the four economic classes used in the previous chapter.
Figure 6-12  Distribution of employees and residents per station (%)

Shibuya: distribution workers and population

1  62%
2  28%
3  4%
4  5%
5  1%

Yokohama: distribution of workers and population

1  57%
2  34%
3  1%
4  5%
5  3%

Jiyugaoka: distribution of workers and population

1  30%
2  12%
3  2%
4  0%
5  49%

Naka Meguro: distribution of workers and population

1  30%
2  11%
3  0%
4  6%
5  53%

Legend
- Offices
- Retail
- Industry and distribution
- Education, health
- Residents
The patterns displayed above allow us to categorize stations according to their functional profile. The following station profiles can be distinguished:

1. Residential stations: stations where the residential function is overrepresented. In this example Tamagawa, Den en Chofu and Kikuna can be categorized as such.
2. Residential - office stations: stations where besides the residential function, offices are strongly represented. The station of Naka Meguro can be categorized as such.
3. Residential-office-retail stations: stations where besides the residential function, both offices and retail are strongly represented. Musashi Kosugi can be categorized as such.
4. Residential-retail stations: stations where besides the residential function, retail is strongly represented. Jiyugaoka can be categorized as such.
5. Office-retail stations: stations where besides offices, retail is strongly represented. Shibuya and Yokohama can be categorized as such.

Figures 6-13 and 6-14 illustrate how these profiles are related to their position in the node-place model and to their position in the railway corridor.

Figure 6-13  Station profiles and their position in the node-place model

Figure 6-14  Station profiles and their position in the railway corridor

Workforce

Figure 6-13 illustrates that stations with an intermediate position in the node-place model tend to be the most multifunctional ones. In other words, the stations located an average distance from the CBD and with an average number of train connections
have a workforce that is relatively equally distributed over the four economic sectors. Stations belonging to this category have an average workforce of 18,000 people, 3 different train connections and are located 15 kilometres from the CBD. Moving down the line of the node-place model, the population share gets stronger at the cost of the total workforce which gets smaller. Moving up the line a reverse pattern can be seen, i.e. as the share of office workers increases the population share decreases. The top and the base of the node-place model tend thus to be relatively monofunctional. This is closely related to the distinguished density pattern discussed above. Stations with relatively high density levels, e.g. Shibuya and Yokohama, tend to have relatively monofunctional station profiles. They are either office or office-retail stations. Stations with relatively low density levels, e.g. Tamagawa and Den en Chofu tend to have relatively monofunctional station profiles as well and are considered residential stations.

Figure 6-14 demonstrates that within a railway corridor different functional profiles can be distinguished. In general, the urban sub centres situated at the beginning and/or end of the line (Shibuya and Yokohama) tend to be dominated by offices and retail. In between these sub centres a variety of functional profiles can be found. Interestingly the most multifunctional stations tend to be located somewhere in the middle of the line, such as Jiyugaoka and Musashi Kosugi on the Toyoko line. First and foremost this is caused by the business strategy pursued by Tokyu Corporation. The core of its growth strategy focuses on creating synergies between its transport, real estate and retail departments. By placing activities (e.g. shopping malls, universities, hospitals and offices) somewhere in between the line bi-directional and off-peak travel can be promoted. Consequently, a more efficient railway operation can be realized. In addition, such activities can lead to more customers and consequently increased sales (see for instance figure 6-6b). And last but not least, the development of attractive facilities will have a positive influence on the surroundings of a station, illustrated by the increased land and rent prices.

Furthermore, the government can also help in attracting certain functions to a station area or in stimulating the development of certain stations by offering for example tax incentives to companies, or by using planning incentives. The latter, for example, was the case in Musashi Kosugi station where private developers were offered considerable bonuses for investing in public facilities.

6.3 The Odawara line

The Odawara line is owned and operated by Odakyu Electric Railway Corporation (OER) which is another major private railway company operating in the Tokyo metropolitan area. Its headquarters is in Shinjuku. OER owns and operates 3 railway lines with a total length of 120.5 kilometres in the area to the southwest of Shinjuku (see figure 6-15). In addition, it also operates bus services acting as feeders for its railway network. Other transport services include taxis and tourist boats.
What sets OER apart from other private railway operators is that its railway lines run through various tourist and leisure areas such as Hakone (famous for its spas) and Enoshima (popular beach spot).

Figure 6-15  Regional map of Odakyu Electric railway lines


OER forms the core of the Odakyu Group which, like many other railway companies in Japan, is involved in several non-transportation businesses like real estate, retail and other services such as financing (credit card), fiber optic networking and travel sales. The Odakyu Group owns department stores, a number of hotels, and a chain of supermarkets, convenience stores and kiosk outlets. Furthermore, the Odakyu Group owns several recreational facilities including a golf course, camping ground, a hot spring resort, and a sailing resort. Most of the recreational facilities are situated at the end of their lines to generate off-peak travel demand and to stimulate bi-directional (i.e. away from Shinjuku station) traffic flows.

The corporate philosophy adhered to by the Odakyu Group is to create ‘irreplaceable times’ and ‘rich and comfortable lifestyles’ for its customers along its railway lines (OER, 2009). Based on this thinking, the Odakyu Group seeks to improve the value of its services offered to customers. These services centre in particular on transportation, retail and real estate, or as they call it ‘door-to-door services’, ‘lifestyles’ and ‘living spaces’. In its business vision OER has outlined three growth strategies, which they refer
to as ‘scenarios,’ that are integrally applied to its business domains of transportation, retail and real estate, and to the area served by its railway lines (OER, 2008):

- **Scenario 1: Better quality services:** increase the competitiveness in all sectors by providing better quality services.
  a. Transportation: continuation of multiple double tracks project
  b. Retail: floor renewal of shopping complexes
  c. Real estate: integration of real estate sales and after-service businesses

- **Scenario 2: Enhanced menu of services:** commencement of new services or business that provide better living environments for customers
  a. Transportation: planning of new train tickets
  b. Retail: expansion of travel package menus for foreign tourists
  c. Real estate: expansion of heat energy supply business

- **Scenario 3: Enhance the features of the areas along the lines:** establishment of stable business structure in existing and new areas by opening new stores.
  a. Transportation: new bus lines
  b. Retail: new stores of existing brands (supermarkets, bakery stores)
  c. Real estate: medium-term acquisition plan of developable land

The Odakyu Group has divided its railway territory into four business regions: Shinjuku, Setagaya, Tama and Hakone (see figure 6-15). For each business region it has developed a specific area strategy based on the image of the area. For example, Shinjuku is one of the main commercial and business centres of Tokyo. As such the Odakyu Group is seeking to increase its presence in this area by expanding its commercial and business facilities here.

### 6.3.1 Corridor morphology

| Facts and figures of the Odawara line (section between Shinjuku and Shin-Yurigaoka) |
|---------------------------------|------------------|
| Length in kilometres\(^a\):     | 21.5             |
| Number of stations\(^b\):       | 23               |
| Year opened:                    | 1927             |
| Number of passengers per day (excluding transfer) | 1.1 million |
| Travel time:                    | 35 minutes (by rapid express) |
| Maximum speed:                  | 110 km/h         |
| Congestion ratio:               | 192%\(^c\)       |

\(^a\) The whole Odawara line is 82.5 kilometres.
\(^b\) The whole Odawara line has 47 stations.
\(^c\) The congestion ratio of 192% concerns a section of the Odawara line (i.e. Setagaya Daita-Shimokitazawa).
selection criterion of having at least one transfer option to another railway line. Shin-Yurigaoka is the last station located within 30 kilometres of Tokyo station that has a transfer option to another railway line (see figure 6-16). Thus the analysis carried out here concerns only a section of the Odawara line, i.e. the segment between Shinjuku and Shin-Yurigaoka.

Figure 6-16  Analysed section of the Odawara line

The corridor morphology is analyzed by travel time and distance of stations to the nearest sub-centre, their passenger numbers, and the type and number of services offered at each station (see figures 6-17a through 6-17c).

Figure 6-17a  Distance in kilometres and travel time to Shinjuku

<table>
<thead>
<tr>
<th>Station</th>
<th>Distance (km)</th>
<th>Travel Time (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shinjuku</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Yoyogi-Uehara</td>
<td>3.5</td>
<td>8</td>
</tr>
<tr>
<td>Shimokitazawa</td>
<td>4.9</td>
<td>10</td>
</tr>
<tr>
<td>Noborito</td>
<td>15.2</td>
<td>23</td>
</tr>
<tr>
<td>Shin-Yurigaoka</td>
<td>21.5</td>
<td>35</td>
</tr>
</tbody>
</table>

Figure 6-17b  Daily passenger numbers excluding transfers (x 1000)

<table>
<thead>
<tr>
<th>Station</th>
<th>Passenger Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shinjuku</td>
<td>234</td>
</tr>
<tr>
<td>Yoyogi-Uehara</td>
<td>38</td>
</tr>
<tr>
<td>Shimokitazawa</td>
<td>54</td>
</tr>
<tr>
<td>Noborito</td>
<td>64</td>
</tr>
<tr>
<td>Shin-Yurigaoka</td>
<td>92</td>
</tr>
</tbody>
</table>
6.3.2 Assigned densities

The designated FAR-values for the areas directly bordering the five selected stations were found on the Tokyo Metropolitan Government and the Kawasaki City websites. Accordingly, the densities are related to the position of each station in the node place model and in the railway corridor. This is illustrated in figures 6-18 and 6-19.

Also figure 6-18, albeit less clear than in figure 6-9, illustrates a certain hierarchical pattern when plotting the densities in the node-place model; stations with a higher position in the node-place model tend to have a higher assigned density. An exception to this is the station of Shin-Yurigaoka as this station has a relatively high assigned density level compared to its position in the node-place model. An explanation for this...
is that Shin-Yurigaoka serves as a regional centre for residents living along the Odawara line. Around the station many department stores and a public library can be found. What might have further triggered its development potential, and thus for Kawasaki City to assign it a higher density level, is that it will become the future terminus for both the Yokohama and Kawasaki municipal subway lines. Shin-Yurigaoka station is situated somewhere in between the Odawara line, although for analytical purposes this is illustrated differently in figure 6-18. Therefore, its current status as a regional centre can also be seen as a means to stimulate off-peak and bi-directional traffic flows (i.e. away from Shinjuku station). Consequently, this can help to make the railway operations of the Odakyu Group more efficient.

In figure 6-19 the assigned density levels of the stations belonging to the analyzed section of the Odawara line are illustrated. This figure demonstrates that density levels vary considerably along the Odawara line. In general, the highest densities are assigned to the sub-centres, which are in the case of the Odawara line Shinjuku and the regional centre of Shin-Yurigaoka. The intermediate stations show a relatively low and similar density level. Interestingly, there are some stations that clearly stand out in comparison to their neighbouring stations such as Shimokitazawa, KyodoNoborito and Mukogaoka Yuen (see the arrows in figure 6-19). These stations all serve as important sub-regional centres along the Odawara line, highlighted by the fact that local governments have assigned them higher density levels. However, in contrast to the Toyoko line, none of these stations are specifically designated by the government as sub centre. As such they do not need to draw developments away from the city centre of Tokyo. Interestingly, around each station redevelopments are taking or are going to take place. For example in Noborito the station building and platforms have been remodelled, in Kyodo a former train shed site will be redeveloped, in Shimokitazawa the existing railway lines have been put underground, and in Mukogaoka Yuen the station area will be redeveloped. This might bring additional opportunities for the Odakyu Group to generate synergies between its railway, real estate and retail departments since they are one of the main landowners in the station areas concerned.
6.3.3 Functional diversity

Based on a GIS-computation the number of employees and residents within 700 metres of the selected stations has been calculated. The figure below illustrates how these data are distributed within a station area when considering the four economic classes used in the previous chapter.
Figure 6-20  

Distribution of employees and residents (%) 

Shinjuku: distribution of workers and population

Yoyogi Uehara: distribution of workers and population

Shimokitazawa: distribution of workers and population
Based upon the patterns displayed above the stations can be categorized according to their functional profiles. Consequently, the following profiles are distinguished:

1. **Residential stations:** stations where the residential function is overrepresented. Noborito station can be categorized as such.
2. **Residential-office-retail stations:** stations where besides a strong residential function, both offices and retail are well-represented. The stations of Yoyogi Uehara and Shin-Yurigaoka can be categorized as such.
3. **Residential-retail stations:** stations where besides a strong residential function, retail are well-represented. Shimo-kitazawa station can be categorized as such.
4. **Office-retail stations:** stations where besides a strong office function, retail are well-represented. Shinjuku station serves as an example for this category.
Similar to the functional pattern of the Toyoko line, figure 6-21 illustrates that stations with an intermediate position in the node-place model tend to be the most multifunctional ones. Here they are the station areas of Shimokitazawa, Yoyogi and Shin-Yurigaoka. The top and the base of the node-place model tend to be relatively monofunctional. This closely corresponds to the distinguished density pattern discussed earlier. Stations with relatively high density levels, such as Shinjuku, tend to have a relatively monofunctional station profile as these stations are considered office-retail stations. Stations with relatively low density levels, e.g. Tamagawa and Den en Chofu, tend to have relatively monofunctional station profiles as they are considered residential stations.

Figure 6-22 demonstrates that also within the Odawara line different functional profiles can be distinguished. The urban sub-centre of Shinjuku is situated at the beginning of the line and tends to be dominated by offices and retail. The regional centre of Shin-Yurigaoka has a more diverse functional profile and is in reality located somewhere in the middle of the line. Similar to Tokyu Corporation this should be regarded as an
outcome of its business strategy. For the Odakyu Group a close cooperation between its transport, real estate and retail departments is central to its growth strategy, because in this way synergy can be realized. Furthermore, the government can also help to attract certain functions to a station area. For instance, in the case of Shin-Yurigaoka station public investments such as the extension of the Kawasaki and Yokohama municipal subway lines may lead to additional private sector investments in the surrounding area due to improved accessibility.

6.4 Conclusion

In the previous paragraphs two railway corridors were analyzed by their morphological, density and functional patterns. These patterns were explored in two ways:

1. By looking at how density and functional patterns are related to the position of a station in the node-place model
2. By looking at how density and functional patterns are related to the position of a station in the railway corridor

In this final paragraph an answer will be given to the questions posed at the beginning of this chapter.

1. Does a focus on a railway corridor allow for locations to be planned and developed in a coherent way?

   This question seems to be answered positively. Both private railway companies have made area strategies for either their whole railway line (Tokyu line) or parts of it (Odakyu line). These strategies have enabled a hierarchical development pattern to occur along the railway corridor, with the highest peaks (i.e. highest assigned densities) to be found at the beginning and end of the line and some additional high peaks (relatively high peaks) to be found in between the line. In addition, they have also contributed to a diversified functional pattern to be found along the railway line, with relatively monofunctional stations to be found at the beginning and end of the line, and stations with more diversified functions to be found in the middle of the line. Consequently, it seems fair to conclude that (sub) regional planning strategies such as the area strategies have, at least to some extent, allowed for a corridor to be planned in a coherent way. In addition, local governments exert some influence on the development patterns of railway corridors as they have the authority to assign the density levels and have the means (e.g. tax incentives) to attract certain functions to stations.

2. Does a focus on a railway corridor result in synergies between station areas, or in other words, is it a useful tool for preventing competition between them?

   This question seems to be answered positively. Generating synergy between transport, real estate and retail stands at the core of the business strategies pursued by Tokyu Corporation and the Odakyu Group. In line with the area
strategy, the location and type of new businesses and services is carefully planned along its railway lines. This is done to attract more passengers during off-peak hours and to generate bi-directional traffic flows to increase the number of customers and consequently increase the number of sales. Figures 6-6a and 6-6b show that this can work out quite well. Eventually, these new businesses and services should make stations areas more attractive resulting in an increase in land and rent prices. As the development patterns within a railway corridor have illustrated there are several types of centres to be found along a railway line ranging from metropolitan sub centres to sub-regional and regional sub-centres. These do not have the same functional patterns as both corridor analyses have illustrated. Within the station area of urban sub centres office and retail functions tend to dominate, while in the sub-regional and sub centres also other functions such as residences are represented. Although there are multiple (sub) regional sub-centres to be found along one railway line differentiation and individualization between them is encouraged. For example, Tokyu Corporation has made a Retail Refinement Plan in which stations are categorized into five retail types serving a particular market and focusing on specific facilities. Also the Odakyu Group focuses on promoting a wide diversity of businesses around its individual stations. These businesses should reflect the character of a particular business region and should supplement the existing services offered to customers. Consequently, it seems fair to conclude that stations along a railway corridor tend to complement each other and competition is prevented due to the diversity in functional profiles and catchment area.

3. **Does a focus on railway corridors allow for a better coordination between different modes of transport?**

This question seems to be answered positively. Both private railway companies offer bus services that either provide complementary services to their existing railway network or act as feeders to its railway network. The buses connect the stations with the surrounding residential neighbourhoods and enable people that live beyond walking distance to a station to use it for carrying out their daily activities. Thus, the bus services help to expand the service coverage area of a station. Whether this tends to be better coordinated in a network or a corridor is difficult to say. However, as we have seen in the introduction, Tokyo does not have one coordinating body for its metropolitan railway network, but instead multiple bodies each operating their own smaller network. Despite this focus, railway companies do cooperate with each other on matters involving the metropolitan network as a whole. And last but not least, private railway operators use each other’s network by operating mutual direct train services. In this way the accessibility to areas outside their own ‘territories’ is improved. Moreover, the need for passengers to transfer is reduced, thereby enhancing passenger convenience. Consequently, in Tokyo coordination between transport services takes place at different levels (i.e regional and local level).
4. **Does a focus on railway corridors result in off-peak travel and bi-directional traffic flows?**

This question seems to be answered positively. The passenger flows within a railway corridor seem to indicate that, besides the sub centres at the beginning and end of the line, there are also centres somewhere in the middle of the line that are able to attract considerable numbers of passengers (see figures 6-8b and 6-17b). Private railway companies like Tokyu Corporation and Odakyu Corporation have been very successful in drawing universities to their station areas. Universities are usually not located at a sub-centre, but instead somewhere in between the line. This is done deliberately to generate bi-directional traffic flows. In addition, a function like a university is able to stimulate off-peak travel. In a similar fashion some amusement functions (e.g. golf court, theme park) are deliberately planned at the end of a railway line. Besides practical reasons (there is hardly space to develop amusement functions within the built-up urban area) such functions are able to generate considerable off-peak travel and bi-directional (i.e. away from the urban sub-centre) traffic flows. Consequently, it seems fair to conclude that by carefully planning functions along a railway line transport operations can be made more efficient.

This indicates that railway corridors seem to be a logical unit for coordinating transport and land use developments at a regional level as it has clear advantages compared to focusing on single station areas. This does not imply that a focus on corridors is better than a focus on the whole network. However, what this corridor analysis has demonstrated is that a focus on corridors can work and does not have to result into an inconsistent metropolitan railway network. Conversely, a network focus, and thus the process and content complexities associated with it, are not always required for successfully coordinating transport and land use developments at a regional level.