2. CHAPTER TWO: TOKYO'S RAILWAY VIADUCTS - AND OVERVIEW

2.1 INTRODUCTION

In Tokyo there are more than 50 km of elevated rail tracks or viaducts, in which the structure is elevated on pillars. This total length equals to about 750,000 sqm of space (at ground floor only), not including areas for stations. Out of 23 stretches of elevated tracks, only 4 have an extensive use of their spaces below. From observations done using Google Earth street view and walks along the viaducts, it is assumed that only 40% of the spaces below are actually being utilized (this figure does not include uses of parking).

2.2 MAP OF ELEVATED RAILWAYS IN TOKYO

The map on the right indicates 23 stretches of elevated railways or viaducts belonging to 15 different train and metro lines where the spaces below are utilized or have the potential to be utilized.

Each viaduct includes information about the year of construction, the distance, the area of spaces below and the main functions of the spaces below the viaduct.

Three levels in terms of the utilization of spaces:

- Spaces below used
- Spaces below partially used
- Spaces below unused

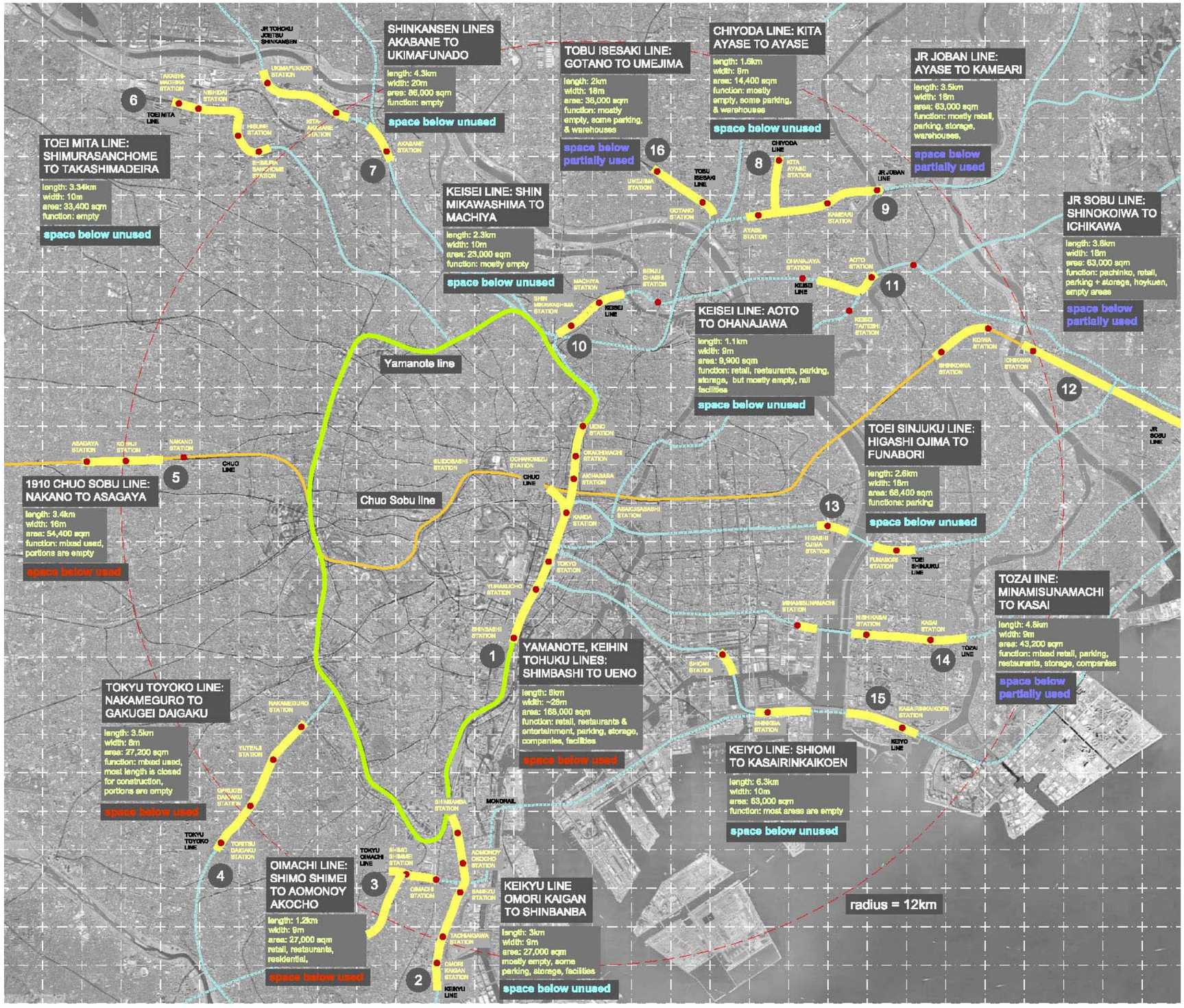

Figure 99 - elevated railways in Tokyo

2.2.1 LENGTH, AREA & FUNCTIONS CHART OF ELEVATED RAILWAYS IN TOKYO (WITHIN 12.5 KM RADIUS FROM CENTER)

#	Lines name	Company	Year of construction	Stations	Distance of elevated tracks *	Width *	Area ***	%	Retail	Pachinko	Restaurants	Bars	Clinic	Residential	Warehouse	Playground / park	Car/rental dealer	Parking
1	Chuo line & Yamanote line	JR East	1910	Shinbashi, Yurakucho, Kanda, Akihabara, Okachimachi, Ueno	5,800 m	30 m	174,000 sqm	22%	O	O	O	O	O	X	o	X	X	O
2	Keikyū Main Line	Keihin Electric Express Railway	1905	Shinbanba, Samezu, Tachiaigawa, Ōmori-Kaigan	4,700 m	9 m	42,300 sqm	5%	X	X	X	X	X	X	X	X	X	o
3	Tokyu Oimachi line	JR East	1927	Shimo shimmei, Oimachi	1,050 m	9 m	9,450 sqm	1%	O	O	O	O	O	O	O	X	O	O
4	Tokyu Toyoko line	Tokyu Corporation	1926	Naka-Meguro, Yūtenji, Gakugeidaigaku, Toritsudaigaku	3,200 m	9 m	28,800 sqm	4%	O	O	O	O	X	X	O	X	O	O
5	Chuo Sobu line (west)	JR East	1910	Kōenji, Asagaya	2,800 m	16 m	44,800 sqm	6%	O	O	O	O	X	X	O	X	O	O
6	Toei Mita line	Tokyo Metro	1968	Shimura-Sanchōme, Hasune, Nishidai, Takashimadaira	3,400 m	10 m	34,000 sqm	4%	O	O	O	O	X	X	O	X	O	O
7	Tohoku Joetsu shinkansen	JR East	1982	Ukimafunado, Kita-Akabane, Akabane	3,800 m	20 m	76,000 sqm	10%	O	X	O	X	X	X	O	X	O	O
8	Chiyoda line	Tokyo Metro	1979	Kita Ayase,	1,600 m	9 m	14,400 sqm	2%	O	X	X	X	X	X	O	X	O	O
9	Joban line	JR East	1889	Ayase, Kameari, Kanamachi	3,300 m	18 m	59,400 sqm	8%	O	X	O	X	X	X	O	X	O	O
10	Keisei main line A	Keisei Electric Railway	1978	Shinmikawashima, Machiya	2,300 m	10 m	23,000 sqm	3%	O	X	X	X	X	X	O	X	O	O
11	Keisei main line B	Keisei Electric Railway	1978	Ohanajaya, Aoto	1,300 m	9 m	11,700 sqm	2%	O	X	X	X	X	X	O	X	X	O
12	Chuo - Sobu line (east)	JR East	1932	Ichikawa, Koiwa, Shinkoiwa	6,900 m	20 m	138,000 sqm	18%	X	X	X	X	X	X	O	X	X	O
13	Toei Shinjuku line	Tokyo Metro	1978	Funabori, Higashi Ojima	1,400 m	10 m	14,000 sqm	2%	X	X	X	X	X	X	O	X	X	O
14	Tozai line	Tokyo Metro	1964	Kasai, Nishikasai, Minamisunamachi	3,400 m	9 m	30,600 sqm	4%	O	X	X	X	X	X	O	X	X	O
15	Keiyo line	JR East	1974	Shiomi, Shinkiba, Kasairinkakoen	4,200 m	10 m	42,000 sqm	5%	O	O	O	O	X	X	O	X	X	O
16	Tobu Isesaki line	Tobu Railway	1899	Gotano, Umejima	2,000 m	18 m	36,000 sqm	5%	X	X	X	X	X	X	O	X	X	O
				Total	51.2 km	15.2 m**	778,450 sqm											

Figure 100 - Elevated railways chart

* Areas and distance were taken based on Google Earth ** Functions excluding stations and railway facilities *** All areas include ground floor only **** Overall usage % is based on an observation – not an accurate figure

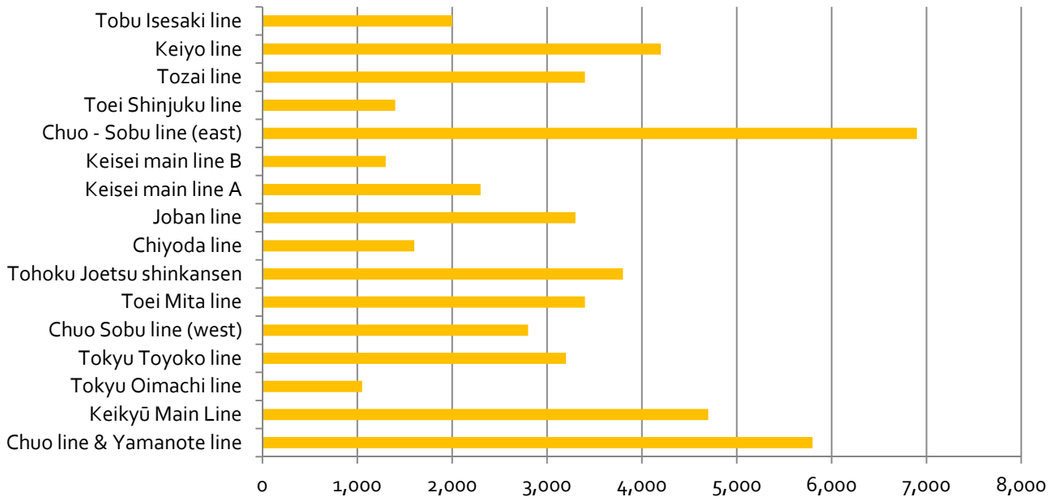

Figure 101 - Chart per length of elevated railways

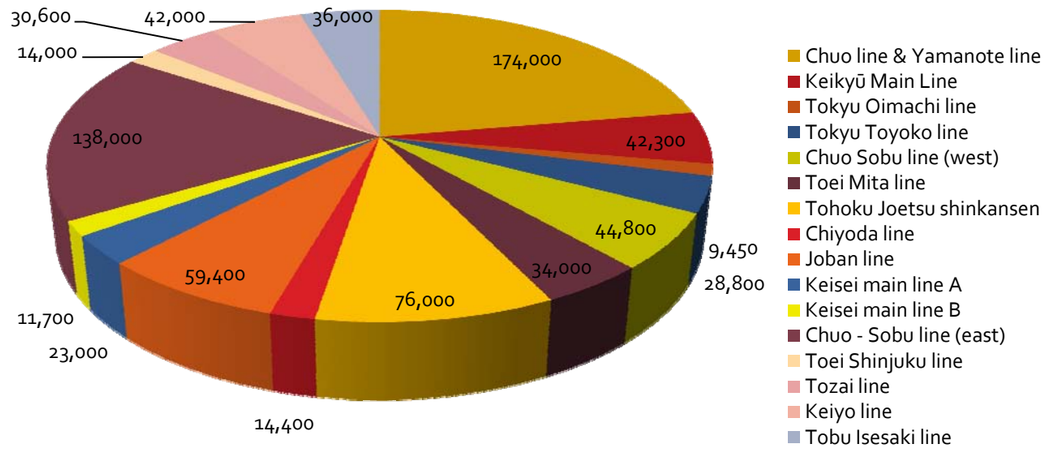

Figure 102 – Pie chart of area of elevated railways

2.2.2 *AREA EQUIVALENT OF THE ELEVATED RAILWAYS IN TOKYO*

To understand the scale of area under the elevated railways (~780,000 sqm) in Tokyo the following are hypothetical examples of functions and areas can be built utilizing the same available area:

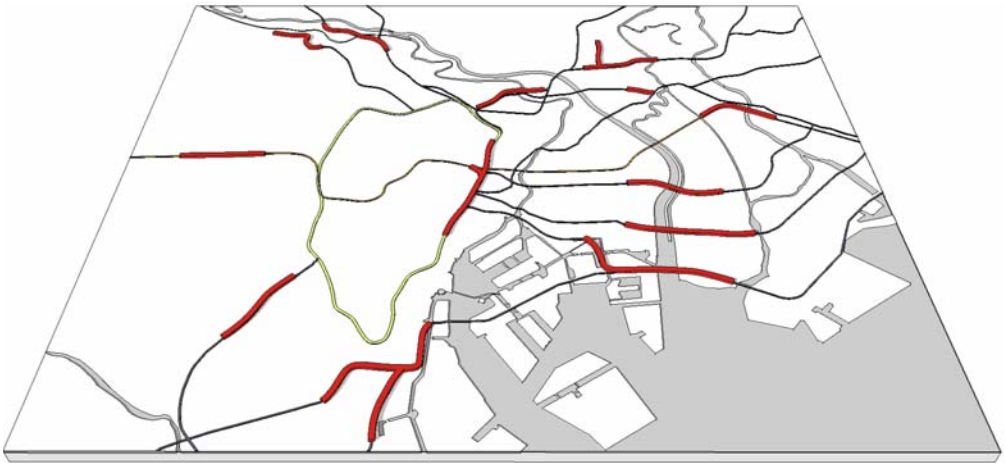

Figure 103 - Diagram of the rail viaducts in Tokyo

Residential					Department stores & Shopping Malls					
Efficiency	70%	=	544,915	sqm	Efficiency	80%	622,760	sqm		
Unit type A	100	sqm	5,449	units	One shopping mall		100,000	sqm	6	malls
Unit type B	60	sqm	9,082	units	One Dept. store		10,000	sqm	62	Dept. stores
Remarks:	One or two stories units				Remarks	Limited in depth - linear narrow….				

Hospitals / Clinics					
Efficiency	80%	622,760	sqm		
One Hospital		20,000	sqm	31	Hospitals
One clinic		5,000	sqm	125	Clinics
Remarks	Limited in depth - linear narrow….				

Kindergartens / Elementary Schools					
Efficiency	75%	583,838	sqm		
Kindergarten		2,000	sqm	292	Kindergartens
Elementary school		5,000	sqm	117	Elementary schools
Remarks	Limited in depth - linear narrow….				

Office buildings						
Assumptions: A 20 floors office building, each floor 1200 sqm						
One bldg	24,000	sqm	Efficiency	80%	622,760	sqm
Total	26	Buildings				
Remarks	Limited in depth - linear narrow….					

Architectural richness of spaces below the viaducts in Japan

Yurakucho

Oimachi

Osaka

Tokyo

Kanda

Kobe

Ueno

Omuta city

Oimachi

Yurakacho

Yurakacho

Okachimachi

Figure 104 – Random selection of photos along Tokyo and Japan's viaducts (images by Arnon)

Architectural richness of spaces below the viaducts in Japan

Ocha no Mizu

Ocha no Mizu

Yutenji

Yurakucho

Ginza

Ueno

Okachimachi

AKI_OKA Artisan

Kanda

Kanda

Keisei Nipori area

Yokohama

Figure 105 – Random selection of photos along Tokyo and Japan's viaducts (images by Arnon)

2.2.3 *A SURVEY OF ELEVATED RAILWAYS AT CENTRAL TOKYO*

The following pages are a summary of 23 stretches of elevated railways (within 16 lines) included in the map (figure 80) and chart (figure 81). The methodology of gathering the information, length and area was based on site visits, photographs, Zenrin maps and Google Earth. The numbers represent a rough estimate and not a definitive number and should be viewed as an impression. The intention of this survey is to give an overall understanding of the viaduct inhabited functions; the adjacent functions & density and an impression of the level of use of the spaces below the viaduct. A further study will be required for deeper understanding of each viaduct unique characteristics and features.

Map's legend:

<u>Observations on the survey of viaducts within a 12.5 km radius in Tokyo:</u>

1. **Correlation between the year the line was constructed and the level of use of the spaces below:** There's a clear correlation between the level of use of the viaducts spaces below and the year it was built. The newer the viaduct is, the less likely that the spaces below are in high use (does not include functions such as bicycle and car parking).
2. **Correlation between location of the line was constructed and the level of use of the spaces below:** The further the lines are from the center of Tokyo the more likely the spaces will be less used.
3. **Residential uses of the spaces below:** Except for Oimachi line and most residential functions have been removed from the viaducts.
4. **The more the viaduct is towards the outskirts of Tokyo the more likely it will be situated along an expressway or a wide road and therefore have the spaces below the viaduct empty or for parking functions only.**

2.2.3.1 Line 1: Yamanote/Chuo Lines

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
1	Chuo line & Yamanote line	JR East	1910	Shinbashi, Yurakucho, Kanda, Akihabara, Okachimachi, Ueno	**Commercial, some residential**	5,800 m	Retail, restaurants, nomiyas, entertainment, companies, parking, logistics, tickets,	**Highly used**

Built starting at the early 20th century (~1910), this stretch of elevated railways is the most intense in terms of use of the spaces below the viaducts.

Starting at Shimbashi and running north up to Ueno station, the viaducts are a superb example of an infrastructure of multiplicity and they serve as a spine of lively urban life. Within these viaducts the areas of Yurakucho, Kanda, Akihabara, Ochanomizu, Okachimachi and Ueno are especially of interest because each area has a unique structure, functions and relationship with the surrounding. Chapters three and four examine the case of Kanda.

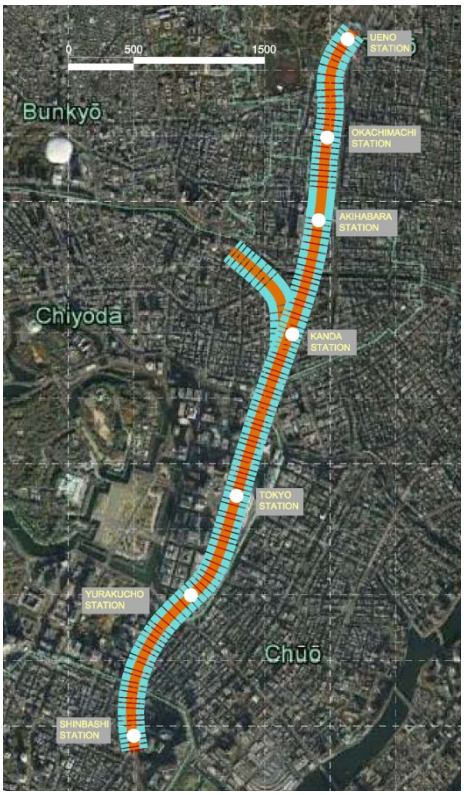

Figure 106 - Yamanote line viaduct Shimbashi to Ueno (Google Earth)

Figure 107 - along the Yamanote viaduct (images by Arnon)

2.2.3.2 Line 2: Keikyū Main Line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
2	Keikyū Main Line	Keihin Electric Express Railway	1905	Shinbanba, Samezu, Tachiaigawa, Ōmori-Kaigan	**Residential, some commercial**	4,700 m	Parking, logistics, fast food restaurants	**Very low**

Figure 108 – viaduct of Keiyo main line (Google Earth)


Figure 109 - images Google Earth

2.2.3.3 Line 3: Tokyu Oimachi line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
3	Tokyu Oimachi line	JR East	1927	Shimo shimmei, Oimachi	**Residential**	1,050 m	Retail, restaurants, nomiyas, entertainment, companies, residential	**Highly used**

This is one of the last viaducts in Tokyo with residential functions.

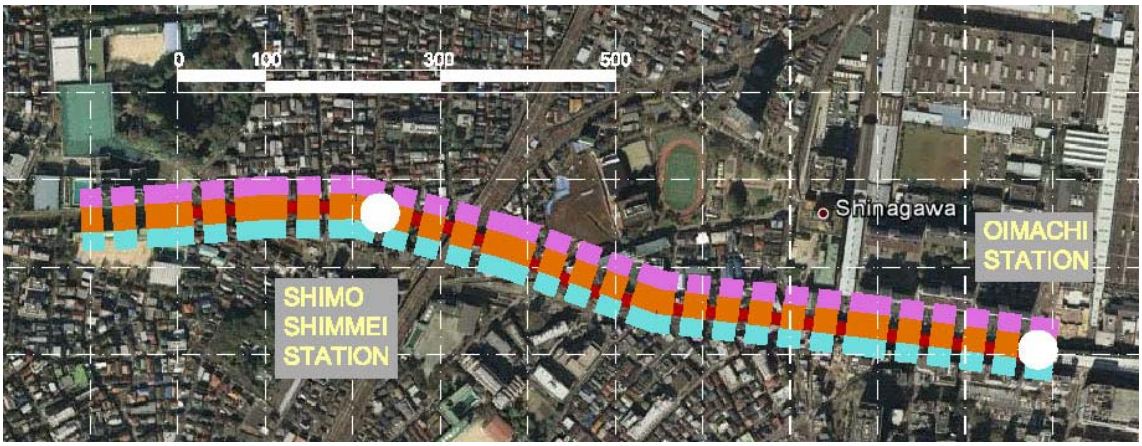

Figure 110 – viaduct of Tokyu Oimachi line (Google Earth)

Figure 111 – along the Oimachi viaduct (photos by Arnon)

2.2.3.4 Line 4: Tokyu Toyoko line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
4	Tokyu Toyoko line	Tokyu Corporation	1926	Naka-Meguro, Yūtenji, Gakugeidaigaku, Toritsudaigaku	**Residential**	3,200 m	Retail, restaurants, nomiyas, companies, parking, logistics.	**Low use**

Runs through residential areas, the spaces below the viaduct are only partially used – usually close to the stations. The rest of the length is either with parking or is fenced and closed.

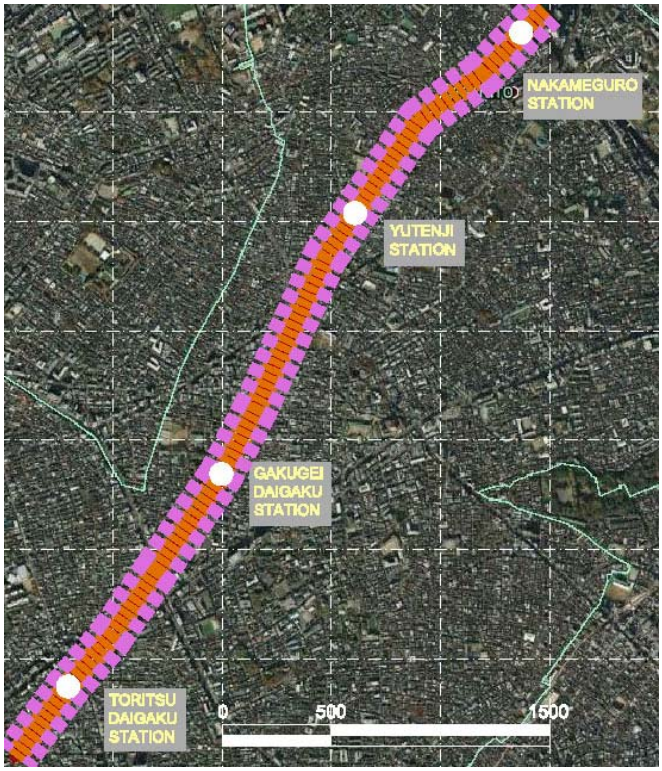

Figure 112 viaduct of Tokyu Toyoko line (Google Erath)

Figure 113 – along the Tokyu Toyoko line viaduct between Nakameguro & Toritsu Daigaku

2.2.3.5 Line 5: Chuo Sobu line (west)

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
5	Chuo Sobu line (west)	JR East	1910	Kōenji, Asagaya	**Residential**	2,800 m	Retail, restaurants, nomiyas, private companies, parking, logistics.	**Medium use**

This viaduct tends to be situated very tightly within residential areas. In some instances the distance from the viaduct to the adjacent buildings is less than 1 meter. Spaces below the viaducts are used near the stations.

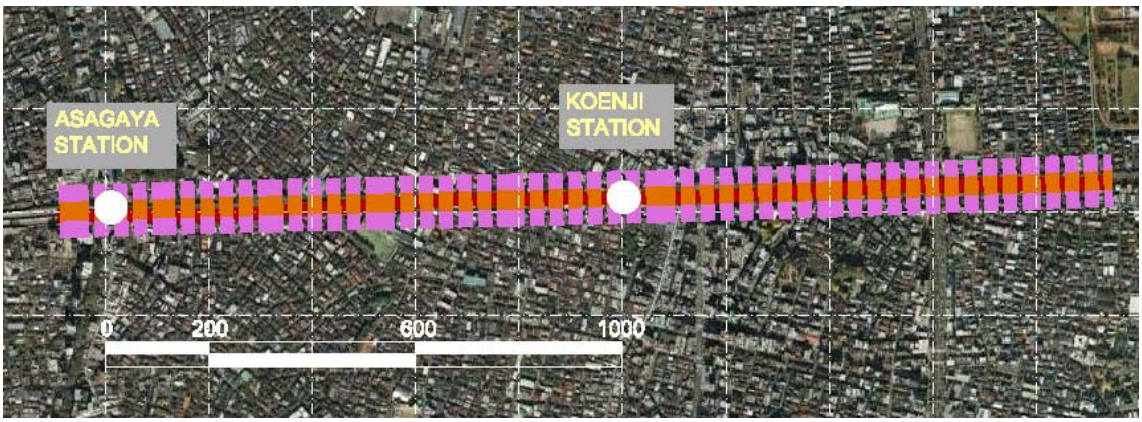

Figure 114

Figure 115

2.2.3.6 Line 6: Toei Mita line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
6	Toei Mita line	Tokyo Metro	1968	Shimura-Sanchōme, Hasune, Nishidai, Takashimadaira	**Residential**	3,400 m	Parking, logistics.	**Low use**

Except for some logistics, parking and storage functions, the viaduct is not utilized at all.

Figure 116 – Mita line viaduct (Google Earth)

Figure 117 – along the Mita line viaduct

2.2.3.7 Line 7: Tohoku Joetsu Shinkansen

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
7	Tohoku Joetsu shinkansen	JR East	1982	Ukimafunado, Kita-Akabane, Akabane	**Residential, some commercial**	3,800 m	Parking, logistics.	**Low use**

Industrial scale viaduct, long span and high ceilings.

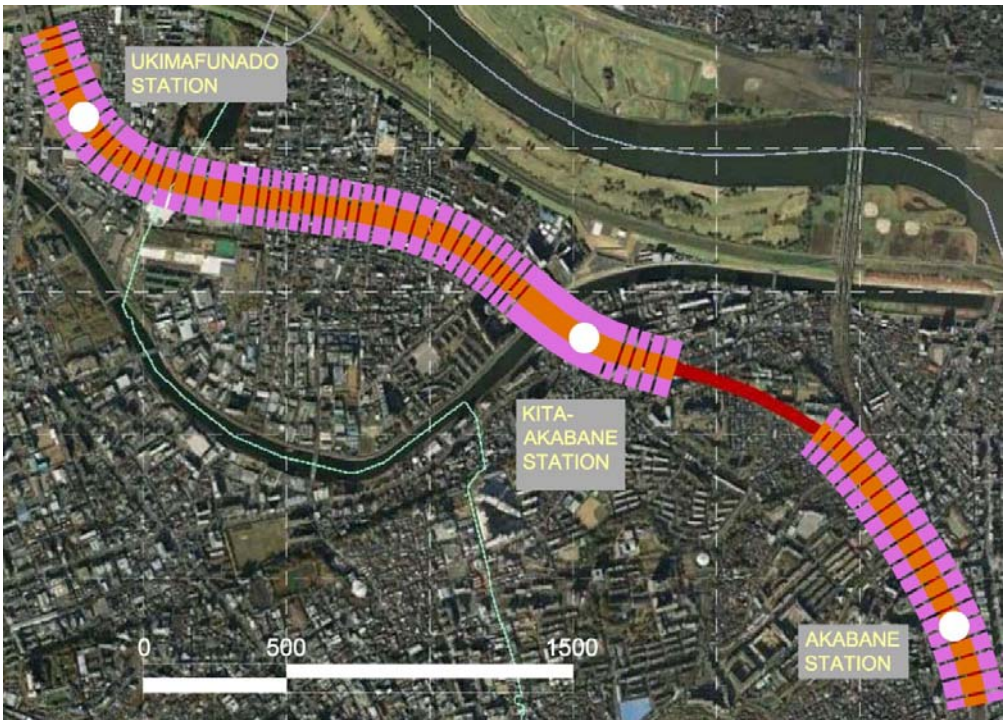

Figure 118 - Tohoku line viaduct (Google Earth)

Figure 119

2.2.3.8 Line 8: Chiyoda line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
8	Chiyoda line	Tokyo Metro	1979	Kita Ayase,	**Residential**	1,600 m	Parking, logistics	**Low use**

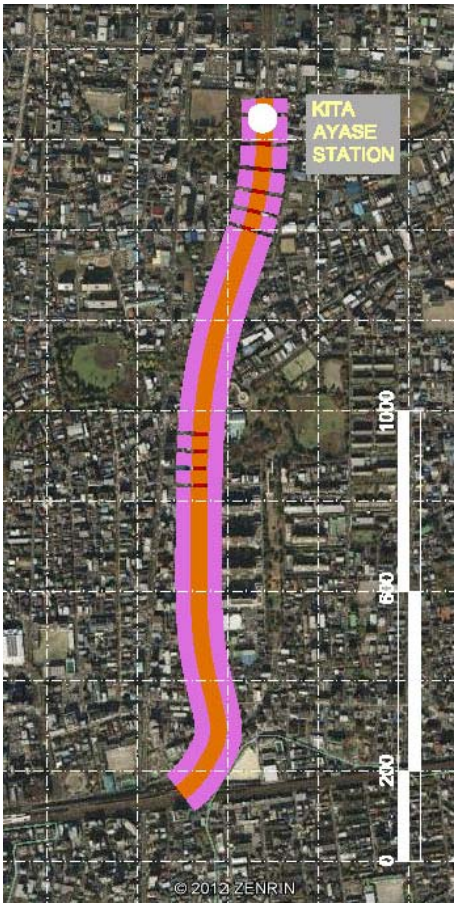

Figure 120 - Chiyoda line viaduct (Google Earth)


Figure 121 - along the Chiyoda line viaduct

2.2.3.9 Line 9: Joban line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
9	Joban line	JR East	1889	Ayase, Kameari, Kanamachi	**Residential**	3,300 m	Retail, restaurants, companies, parking, logistics, pachinko.	**Medium use**

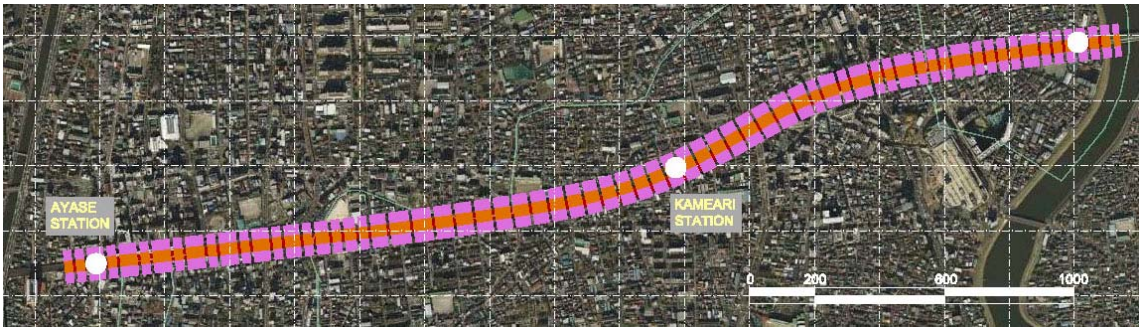

Figure 122 - Joban line viaduct

Figure 123 – Joban line viaduct (images – Google Earth)

2.2.3.10 Lines 10 - 11: Keisei main line A (west) & B (east)

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
10	Keisei main line A, B	Keisei Electric Railway	1978	Shinmikawashima, Machiya	**Residential, some commercial**	4,600 m	Parking, fenced area	**Low use**

Figure 124 - Keisei line elevated rail west and east sections


Figure 125 – Keisei main line west (images Google Earth)

Figure 126 – Keisei main line west (images Google Earth)

2.2.3.11 Line 12: Chuo - Sobu line (east)

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
12	Chuo - Sobu line (east)	JR East	1932	Ichikawa, Koiwa, Shinkoiwa	**Residential, some commercial**	6,900 m	Retail, restaurants, companies, clinics, parking, logistics.	**Medium use**

Except for some logistical functions and parking the viaducts below is mostly empty and under utilized.

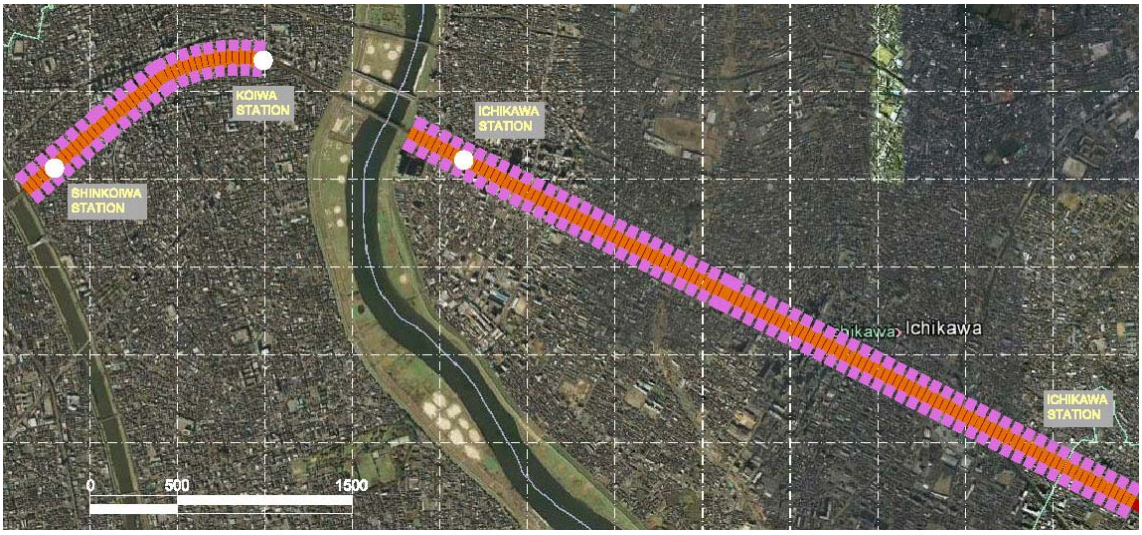

Figure 127 - Sobu line East (Google Earth)


Figure 128 – Cho Sobu line (images Google Earth)

2.2.3.12 Line 13: Toei Shinjuku line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
13	Toei Shinjuku line	Tokyo Metro	1978	Funabori, Higashi Ojima	**Residential, park / leisure**	1,400 m	Parking, logistics	**Low use**

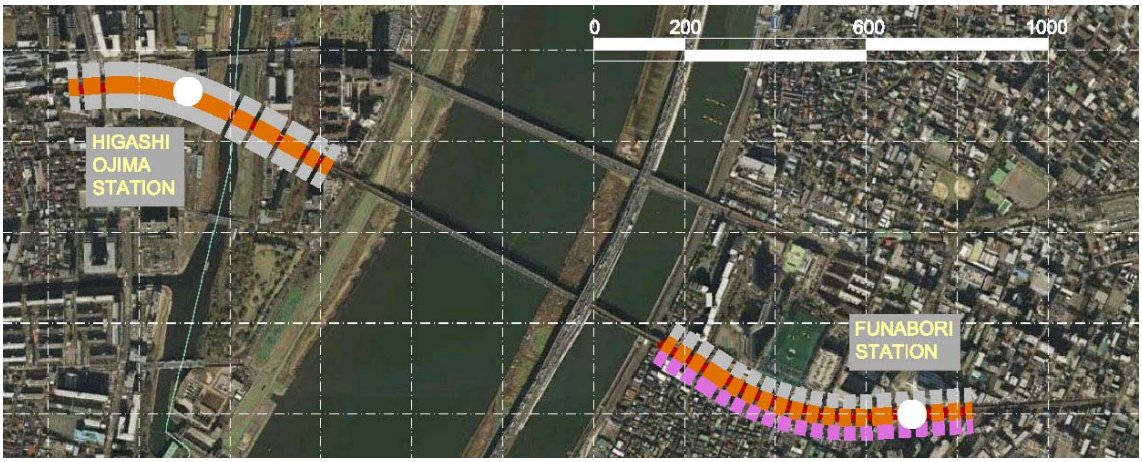

Figure 129 - Toei Shinjuku line


Figure 130 Toei Shinjuku line

2.2.3.13 Line 14: Tozai line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
14	Tozai line	Tokyo Metro	1964	Kasai, Nishikasai, Minamisunamachi	**Residential, some industrial, some comercial**	3,400 m	Parking, logistics, retail	**Low use**

A viaduct with gigantic dimensions very long structural spans and high ceilings to the bottom of the structure. In theory this structure can inhabit large functions such as sports halls and parks. The structure is so high that small buildings easily fit under the viaduct, completely disconnected from the viaduct's structure.

Figure 131 - Tozai line (Google Earth)


Figure 132 - Tozai line (images Google Earth)

2.2.3.14 Line 15: Keiyo line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
15	Keiyo line	JR East	1974	Shiomi, Shinkiba, Kasairinkakoen	**Residential, park / leisure, industrial, expressway**	4,200 m	Parking, logistics, storage, restaurants	**Low use**

Unlike the majority of the viaducts surveyed, the Keiyo line viaduct runs along park and open spaces and some industrial areas, with busy roads on both sides.

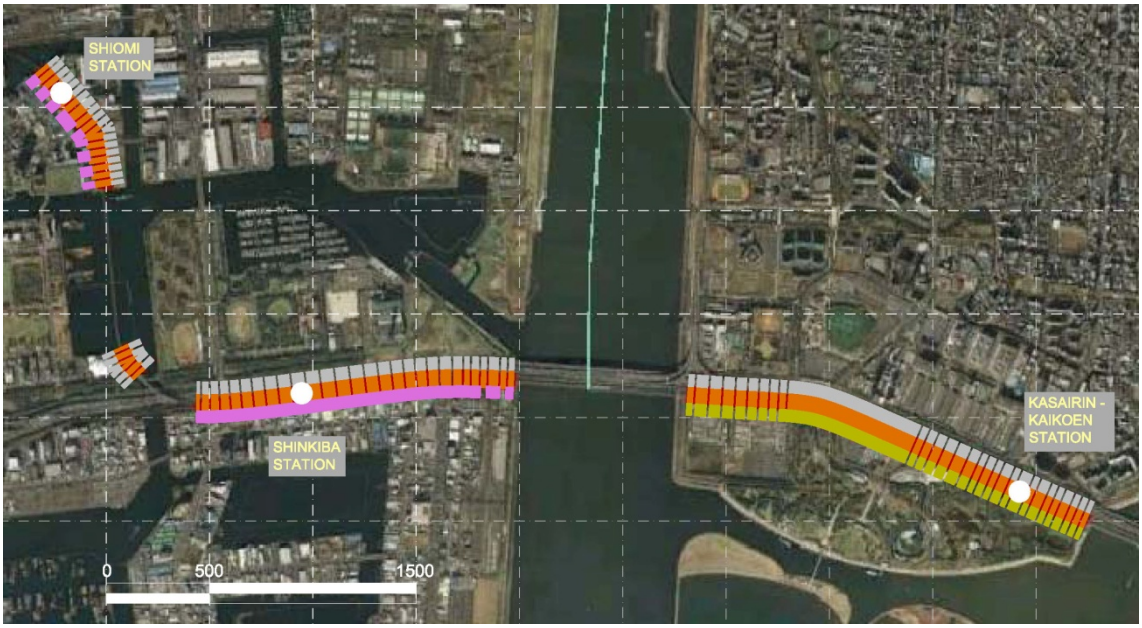

Figure 133 - Keiyo line (map - Google Earth)


Figure 134 – along the Keiyo line viaduct

2.2.3.15 Line 16: Tobu Isesaki line

Map #	Line's name	Company	Year of construction	Stations	Zoning / land use of adjacent area	Distance of elevated tracks *	Functions	Level of use of spaces below the viaducts
16	Tobu Isesaki line	Tobu Railway	1899	Gotano, Umejima	**Residential, some commercial**	2,000 m	Storage, retail, parking,	**Low use**

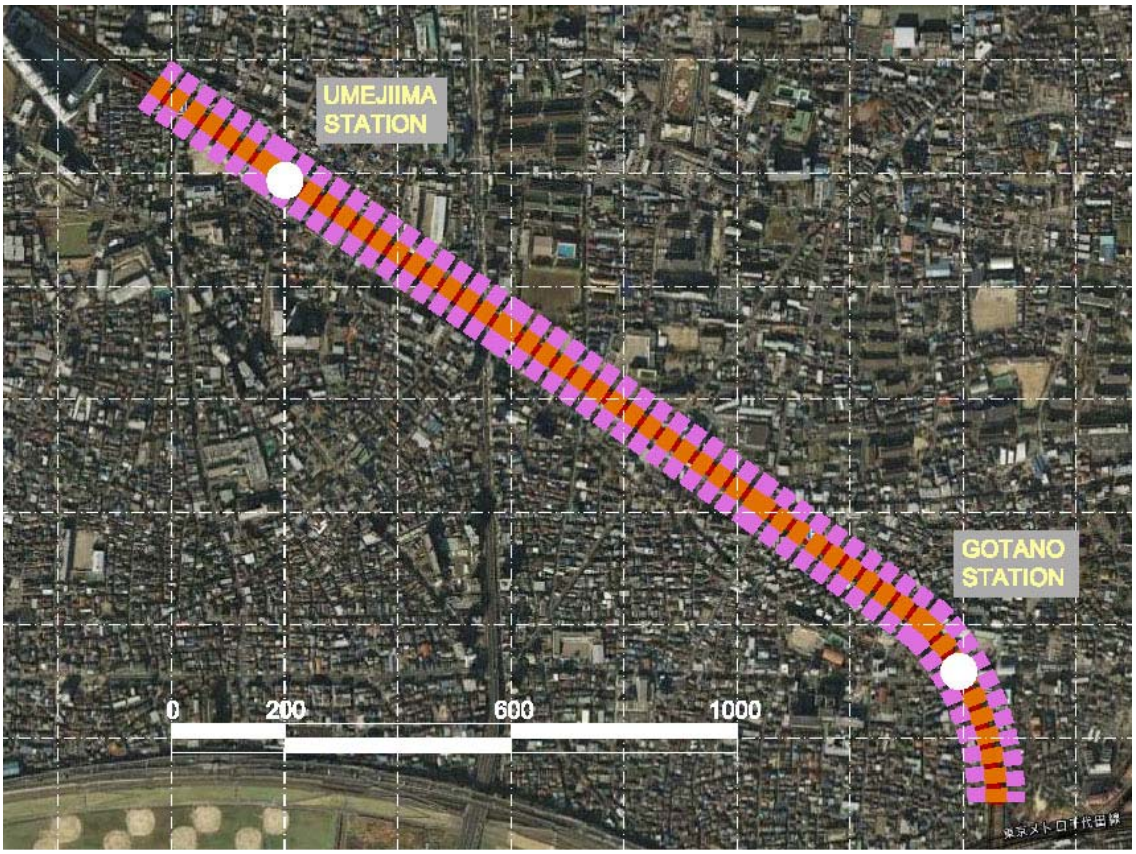

Figure 135 _Tobu Isesaki line (map Google Earth)


Figure 136 - along the Tobu Isesaki line viaduct

2.3 THE CHARACTERISTICS OF THE RAIL VIADUCTS OF TOKYO

2.3.1 *DISSECTING*

In many instances of the viaducts running through Tokyo the viaducts runs at a minimum width of about 9 meters with very minimal easement or setback along its path. Typically this happens within dense residential areas where commercial spaces were not required or could not connect to existing ones such as in Kanda. The reasons for the lack of easement are the following:

- The railway company tried disruption to the neighborhood
- The cost of land purchase and relocation
- Un-restricting zoning and building codes which allowed for almost non existence easement.

A good example of such dissecting viaduct is along the Chuo – Sobu line between the three stations Ogikubo, Asegaya and Koenji. Unlike the case of the old Chuo and Yamanote lines from Shimbashi to Ueno, where a new commercial street was created along the viaduct; in the case of the west portion of the JR Chuo line there is no setback or a street.

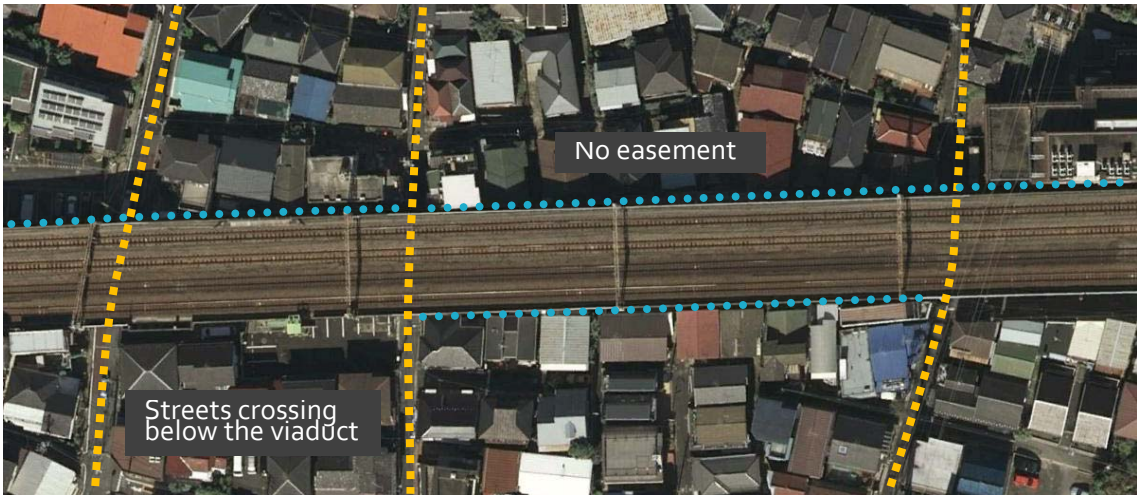

Figure 137 - the JR Chuo line viaduct between Koenji and Asegaya (Google Earth)

Except for where streets are crossing, the rest of the area has tight arranged housing right against the viaduct with spaces of less than one meter (figure 86). This phenomenon creates extreme dense situation where the viaduct is almost touching the adjacent houses.

Figure 138 – houses located right against the viaduct of JR Chuo line

2.3.2 *DIVIDING & SEPARATING*

In cases where the spaces below the viaduct are not inhabited and there's a street running along the on both sides; viaduct acts much more as an urban divider, separating two parts of neighborhoods. Such example is the viaduct of JT Joban line near Kamaeri station. The viaduct is used mostly as a parking area with roads on both sides, making the area unsafe for crossing and a sort of urban desert with no variety of functions, public open spaces or pedestrian connections between the two sides.

Figure 139 - Joban line viaduct between Kamaei & Ayase stations

Figure 140 north and south sides of the JR Joban line

2.3.3 *CONTRASTING*

In some cases the viaduct acts as an urban instrument of contrast. The viaduct serves as a background of sort to provide contrast in terms of scale, function and history. And by doing so it accentuates the local architecture and its specific atmosphere.

Figure 141 – a 'Japanese' style house next to the JR Chuo line viaduct

2.3.4 *MERGING AND UNIFYING*

When the spaces below the viaduct are inhabited and the easement is kept to a minimum the viaduct serves as an urban stitching element the two sides and providing continuity between neighborhoods. The inhabited section of the viaduct of Oimachi line near is an example of such case.

Figure 142 - section of Oimachi viaduct between Oimachi and Shimoshimmei stations

Figure 143 - Oimachi viaduct with large openings for pedestrian crossing

2.3.5 HUMAN / INTIMATE SCALE VS. GIGANTIC / INTIMIDATING SCALE

As clearly understood the vaiducts do not have one typology or standard style. Depending on factors such as sclae of the structure, the span of the columns, the existience or non existence of habitted functions below and the characters of the neighborhood where the viaducts passes - an atmposphere develops which can be of an intimate and human scale or of an intimadating and industrial scale.

Examples of GA DO SHITA on the human - intimate scale:

Figure 144 - JR Chuo line viaduct

Figure 145 - along the Chuo line at Kanda (photo - Arnon)

Examples of GA DO SHITA of an alienating scale

From the survey of the elevated lines, it can be understood that the newer the line the les integrated it is with the surrounding and the more likely that the spaces below the viaduct are of no use at all or are used on a very minimum level of parking and logistical functions. When the viaducts expended to the periphery of Tokyo during the 1960s and 1970s, the viaducts were built with precast concrete structural elements supported on very large spans and with heights of up to 15 meters and more. Examples for such large spans and in a sense alienating structure are the Tozai and Keikyu lines (figures 135, 136, 137).

Figure 146 - along the Tozai line viaduct

Figure 147 - large span at Tozai line viaduct (all three images - Google Earth)

Figure 148 – Keikyu line

2.4 CONCLUSIONS

Level of urban engagement

About 65% of the rail viaducts in Tokyo pass through residential areas with great variety of the way they engage the city on the local scale. The survey in this chapter indicates that the rail viaducts in Tokyo have great variety of architectural and urban expressions. This variety can be valued and categorized on terms of the physical situation:

1. Scale of the structure
2. Structural span and construction technology
3. Distances from the adjacent buildings and streets
4. Existence, variety and intensity of functions below the viaduct
5. Height of structure
6. The existence of an easement along the viaduct
7. The existence of a road or street along the viaduct

All of the above influence the degree in which the viaduct engages the local settings, the urban life of the neighborhood and if it results in contribution to the vitality of a city center or to the opposite – a drain on city life and an urban division.

As can be seen that in the examples of Tozai & Keiyo lines there's little or no engagement at all on the urban level. In these cases the viaduct is perceived as an urban utilitarian element similar to pipes in an apartment building, passing through the city without much relationship and connection on the human scale. The viaduct in these cases is an alien element which causes a division in the urban landscape and creates an urban no man's land. In many cases the railway company controlling the viaduct enhances this unpleasant atmosphere with fences on both sides closing the viaducts to crossing and creating endless parking lots.

The case study of the viaducts in Kanda, as will be explained in the next two chapters is that of high degree of connectivity on the local urban level which is a result of several of factors to be explained in chapters 3 & 4.

Underutilized spaces below the viaducts

Out of 23 stretches of viaducts with open spaces below, 5 lengths are situated within a commercial or industrial surrounding. The rest of the viaducts surveyed are all within residential areas. It is estimated that about 780,000 square meters of space are empty or used for parking only; this is a staggering large area in a city where real estate is so expensive and in short supply. Beside the factors mentioned above of the specific urban layout of the viaducts and the existence of an easement there are other factors which are political economical and of policies managed by the rail companies.