

THE MEDIUM-TERM STRATEGY TO REALIZE MULTI-MODAL MOBILITY IN TOKYO METROPOLITAN REGION

- Coordinated Strategy between Rail and Suburban Development -

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ABSTRACT

In Tokyo the pattern of land use densities follows the pattern of main mass transit networks, and thus, multi-modal urban mobility has been realized at a substantial degree. This is due to the medium-term strategy of coordinated planning and finance between rail transit network development and suburban development. The strategy has long been employed by private rail companies and by public sectors in the Japanese large metropolitan areas including Tokyo.

Throughout the 20th century, the period of lasting urbanization for Japan, one of the policy issues was to provide affordable housing and housing sites to inflowing population to the large metropolitan regions, under soaring land price. In order to develop suburbs at a large scale, the extension or improvement of existing urban rail network (basically formed up by 1920's) was considered to be an effective urban transport policy.

The key concepts of the coordination strategy are twofold. The one is the implementation of suburban development under private rail companies' initiative, supported by central and local governments. The other is re-investment of the gained development benefits to further rail-extension and suburban development by private rail companies. The strategy has been an effective urban transport policy as well as a sustainable business model over years.

1. INTRODUCTION

Urban transport problems are derived from two fundamental changes, i.e. urbanization and motorization. The degree of urban transport problems in mega cities can be attributed to (i) the intensity and speed of urbanization and motorization, (ii) the timing of urbanization and motorization, i.e. whether the both have been overlapped at the same period of time, and (iii) the progress of infrastructure provision, i.e. urban rail and roads. A specific feature of TMR is a high degree of utilization of urban rail and subway in urban transport system.

The Figure 1-1 shows public transport share for commuting trips by world mega cities. Although the share of rail and subway is not specifically indicated here, the rail share in TMR is about 30%, while in central Tokyo, its share is more than 70%. A fundamental question arises, "Why is it so?"

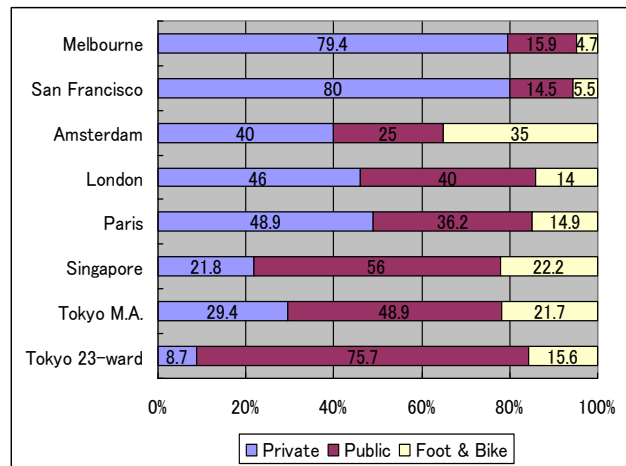


Figure 1-1 Public transport share for commuting trips

In the following, the past trends and practice in three sub-sectors of urban transport in TMR (Figure1-2) would be presented and analysed to find answers to the question.

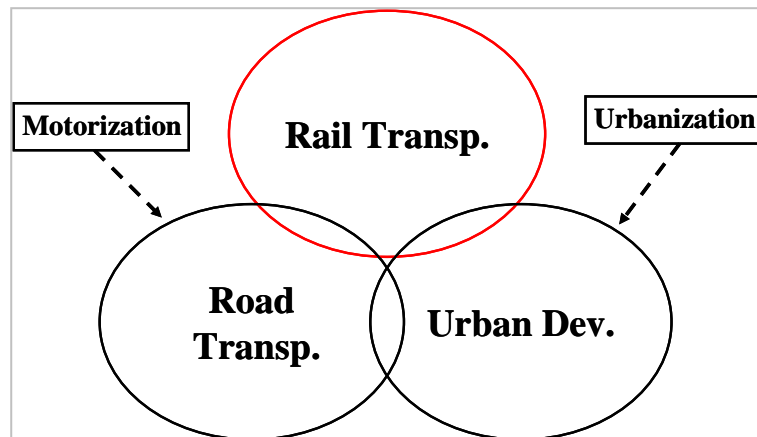


Figure 1-2 Three sub-sectors in urban transport

More specifically, two topics will be presented. The first is long-term trends of urbanization and motorization in Tokyo Metropolitan Region as compared with development of urban transport systems, esp. urban rail system. The second is medium-term coordination strategy between suburban development and rail development.

2. URBANIZATION, MOTORIZATION AND URBAN TRANSPORT SYSTEM IN TMR

2.1. Urbanization in TMR

The Figure 2-1 shows the outline of TMR, comprising with the Tokyo Metropolis and the surrounding three prefectures. The TMR covers the area within 50km radius from central Tokyo. Its population is about 28 million.

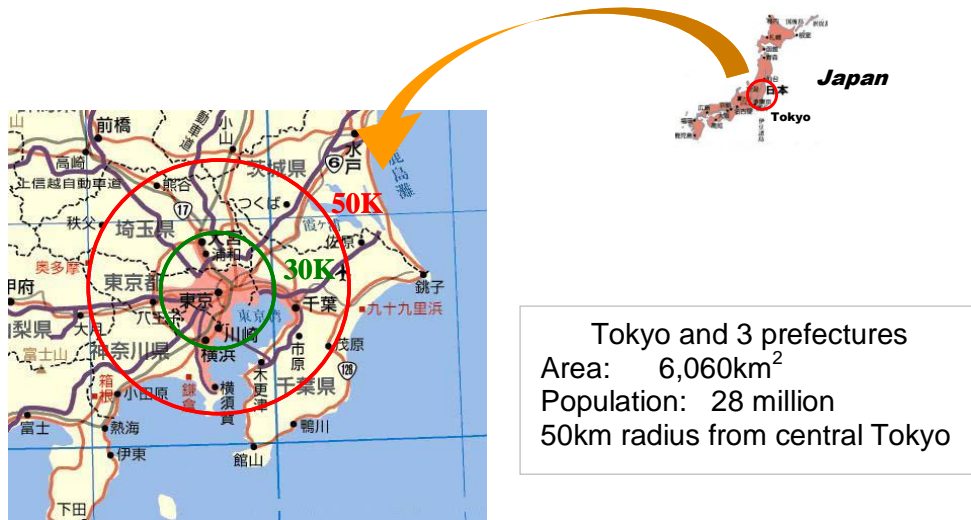


Figure 2-1 Outline of TMR

Throughout the 20th century, the TMR experienced more rapid and sizable urbanization as compared with European and North American Cities. Its urbanization can be divided into three Phases as indicated in Figure 2-2. The pre-war Phase I ('20 – mid '30) was due to industrialization in the field of light industries. The post-war period from mid 50's through 60's represents Phase II urbanization, due to booming heavy and chemical industries. In GNP terms, this period was the age of high-economic growth of Japan. The following Phase III urbanization, from 80's to mid 90's, was due to booming high-tech and service industry. Especially, a sharp population increase can be observed in Phase II.

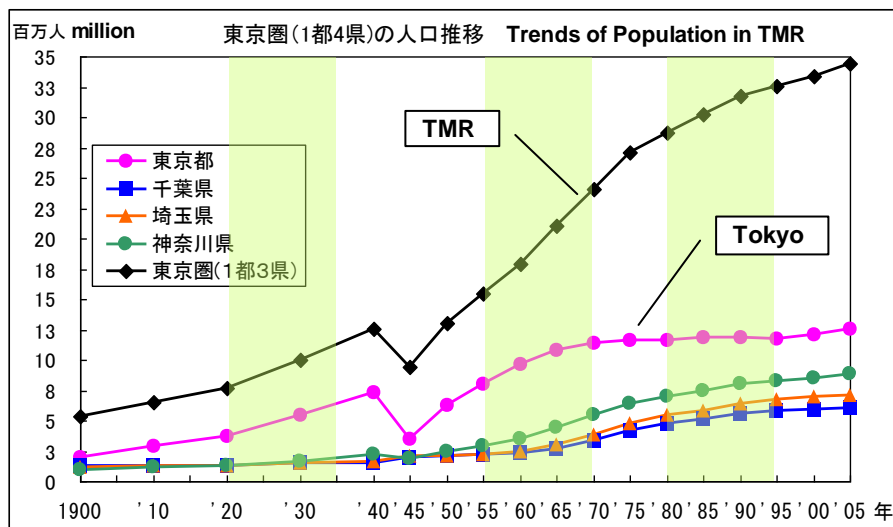


Figure 2-2 Trends of population in TMR

The Figure 2-3 shows the net inflow population into three major metropolitan regions in Japan in post-war period. The red line represents the total of the three regions, and the green line represents TMR. Throughout 60's, annual net inflow into TMR had been more than 350 thousands. The huge inflow, however, decreased sharply in the early 70's. The Phase II urbanization was quite a huge burden from the point of urban transport and urban development. The figure also shows a lower peak around mid 80's, representing Phase III urbanization. From the point of urban transport, however, the Phase III had less importance.

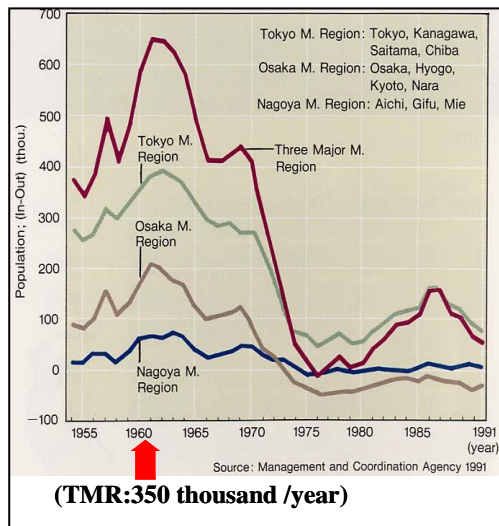


Figure 2-3 Degree of urbanization in Phase II and III

In general, urbanization derives soaring land price in urban area. Soaring land price at the fringe of existing urbanized areas induces land price increase in inner suburbs. Then, people seek for cheaper housing site in outer suburbs. In the Phase II urbanization, one of the urgent policy issues of the national government was to supply affordable housing and housing sites to inflowing population, by planned suburban development both by public and private sector.

2.2. Motorization in TMR

The Figure2-4 shows the trend of motorization in TMR in terms of the number of all registered vehicles. The motorization progressed hand-in-hand with the post-war high-economic growth. In contrast, the degree of motorization had been negligible small at the period of Phase I urbanization. In the other words, in Phase I moderate urbanization, there was no urgent needs for road development.

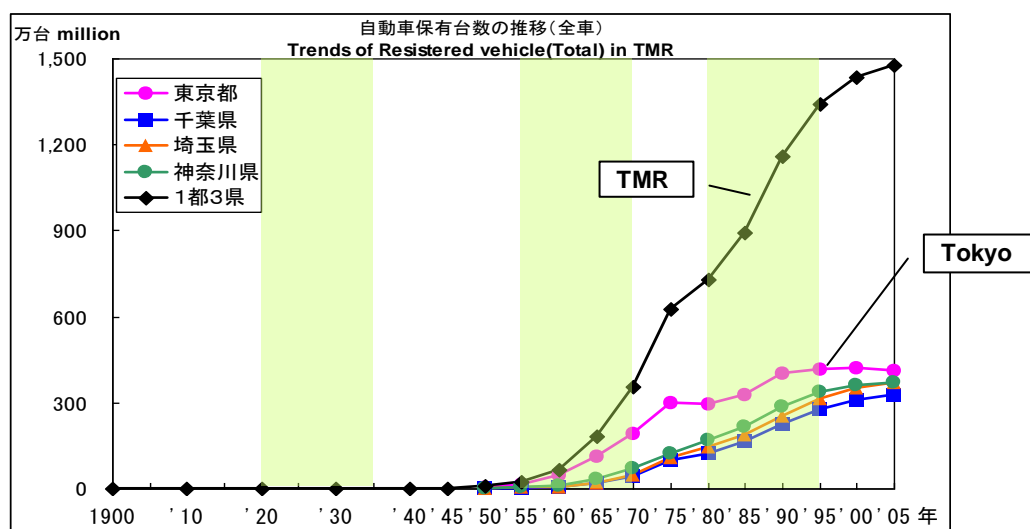


Figure 2-4 Trends of motorization in TMR

2.3. Development of rail network and urbanization in TMR

In TMR, extensive efforts had been exerted to build basic rail network (Figure2-5) by about 1920, which was the early stage of Phase I urbanization. The network had been expanded

further to outer suburbs to cover whole TMR. And the network in 1945 (Figure2-6) looks quite similar to the present one, although most of the lines were single tracked.

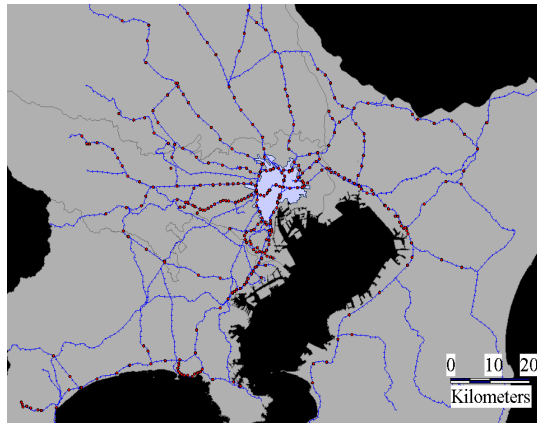


Figure 2-5 Urbanization and rail net before Phase I (- 1923)

In the year of 1923, densely inhabited area (Figure2-6) was quite small, as compared with its rail network. Those rail lines were built both by the national body and numerous private rail companies, mainly for freight transportation. Passenger service, however, had gradually been expanded in line with the progress of urbanization along rail corridors. In the Figure2-6, presented is the expanded densely inhabited area and the obvious increase of stations in service in the suburbs. The rail network, however, had changed little by 1945.

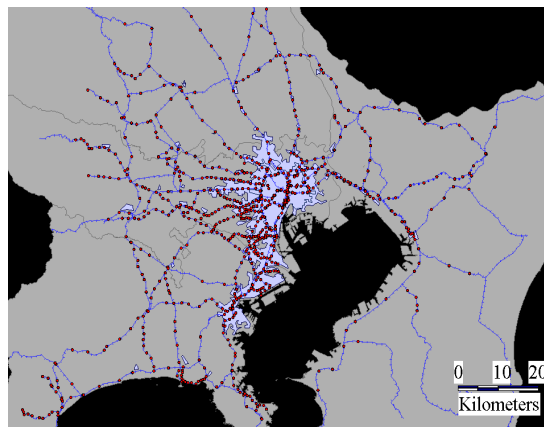


Figure 2-6 Urbanization and rail net in Phase I (1923 - 1945)

Throughout the period of Phase II urbanization, passenger transport had been basically supported by the rail network, already existed. Although network development had continued, the emphasis of rail investment had been placed on transport capacity expansion, by several means, including (i) double tracking, (ii) increase of number of cars in a train, (iii) shorter head-ways, (iv) introduction of express-service.

The Figure2-7 shows rail network development in Phase II and III. Comparing Figure2-6 and 2-7, rail links newly added were quite limited, i.e. new outer ring line, extension of some branches and so forth. However, its transport capacity was increased by 4 - 6 times, in general.

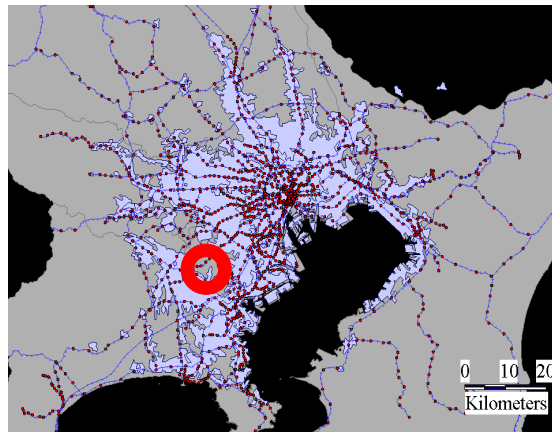


Figure 2-7 Urbanization and rail net in Phase II + III (1945 -)

The Figure2-7 also shows the present status of expanded densely inhabited area, extending like palm-and-fingers. Some newly added rail lines and links can be observed with the expanded densely inhabited area. For example, some new links and extensions in south-west suburbs (indicated by red circle) and in north-west suburbs. You may also notice the increase of new stations opened on the existing lines, which indicates low density development around stations. It should be noted, however, road transport derived from motorization since Phase II period enabled the spread of densely inhabited area between rail corridors and low density development around new stations.

2.4. Subways and trams in TMR

Increase of inbound passengers from the suburbs demanded the increase of transportation capacity in downtown. In the period of Phase I urbanization, tram networks served as downtown transport. During Phase I period, a high density tram network covered central part of Tokyo. At the same time, however, it was felt that tram network would not be enough for growing Tokyo. The first line of Tokyo's subway was opened in Phase I period, more particularly in 1939. During the post-war Phase II urbanization period, the subway construction was accelerated as shown in the Figure2-8. On the other hand, tram network had phased out by 1970. Subway network had been expanded both in Phase II and III by intensive investment with government subsidy. Some subway lines were extended to the suburbs and many new lines were directly connected with existing suburban rail lines for through-service.

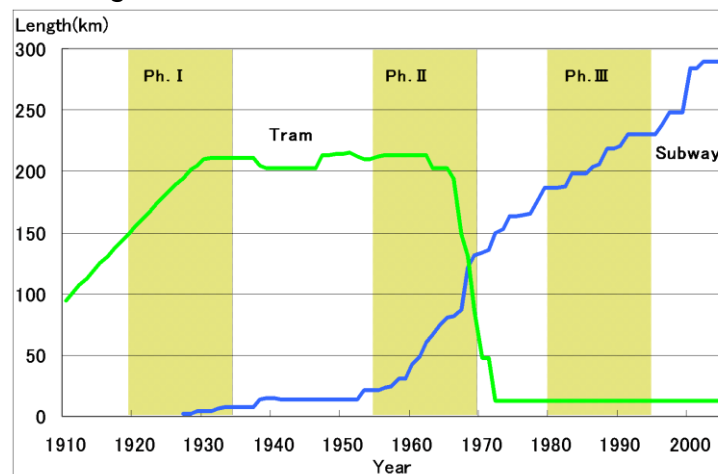


Figure 2-8 Trend of downtown rail-based transport

Source: Yasuo WAKUDA, PRIVATE RAILWAYS OF JAPAN THEIR NETWORKS AND FLEETS

2.5. Urban road network development in TMR

In the period of Phase I urbanization, main streets in urbanized areas were quite narrow. Although the degree of motorization was quite limited, urban road widening had been implemented in the central part of TMR, as a part of restoration project, after the disastrous earthquake in 1923.

In the period Phase II urbanization, Japan experienced very rapid motorization and road network development had been a major concern. To cope with the motorization, the special measures for road development were implemented. Among others, most important was to secure exclusive financial resources derived from gasoline tax revenue. The preparation for the Tokyo Olympic Games in 1964 was a timely challenge for developing urban roads extensively. Within several years, 70KM of arterial urban roads were widened or developed, and 30KM of urban expressway were newly constructed. Even after the Olympic Games, urban road network has been expanded step by step for decades.

2.6. Summary

In the pre-war Phase I period, urbanization was moderate and slow. Motorization was just negligible. By pioneering efforts, basic rail network was almost formed up. Urban development had been implemented mainly in the fringe of central area.

In the post-war Phase II period, in turn, urbanization was overwhelming and rapid. In-flowing population had settled mostly in suburbs. Extensive and rapid motorization overlapped in the same period of time. Rail sector managed to cope with growing passengers from suburbs to the center, by improvement of existing rail network, and by extensive subway construction. Road development, however, failed to cope with urbanization and motorization, despite of extensive construction efforts. In urban development sector, extensive suburban dev. were planned and implemented.

3. COORDINATED PLANNING AND FINANCE BETWEEN URBAN RAIL AND SUBURBAN DEVELOPMENT

3.1. Backgrounds

The captioned coordination strategy had been employed by private rail companies operating in large metropolitan regions in Japan throughout the 20th century. The coordination strategy had been effective against specific backgrounds as follows;

- i) Lasting and huge demand for suburban housing under ever rising land price,
- ii) Suburban detached housing with housing lot had long been regarded as a promising and secure way of asset holding for middle-class people,
- iii) Hilly forest and farmland in the suburbs are mostly subdivided, and agro-forestry production had not been profitable, and
- iv) Those suburban land can be easily developed into suburban housing sites if rail access to the center is provided.

In other word, housing demand was there, and suppliers were ready, if coordination strategy worked well between rail and suburban development.

3.2. Outline of Coordinated Planning and Finance

The coordination strategy employed by private rail companies can be summarized as follows. (1) The first step is to obtain a blanket license of exclusive suburban rail

construction and operation in certain corridor from the national government. (2) The second step is to acquire land tenure in the corridor, and set up development unions with land owners. (3) The third step is to set-up development plans, including rail extension route and location of new stations in accordance with land use plans, authorized by local government. (4) The fourth step is to implement piece by piece development, coupled with rail extension or provision of new station, after obtaining necessary official approvals from the national and local governments. The size and timing of such joint-development should carefully be decided. Because, over supply of developed land or too early rail extension may aggravate financial position of joint-development. (5) The fifth step is to sell out housing and housing site and distribute development benefits among members of development unions. (6) The sixth step is to re-invest for further rail extension and suburban development mobilizing a part of gained development benefits.

Two important considerations are to be reflected in designing the plans for development, as shown in Figure3-1. The first point is a careful choice of land use pattern. A special attention is to be paid not to depend too much on housing development. Because housing community tends to produce one way rail transportation demand in peak hours; in the morning inbound to CBD, and in the evening outbound to suburbs. And, of course, such demand pattern is not desirable from the point of efficiency. What is needed is to introduce different type of land use; i.e. schools and universities, clean industrial estate and research institutes. Students and employers in the suburbs may induce reverse directional transport demand in peak hours, and thus contribute to more efficient rail operation. The second point is the provision of through-service to CBD. Many suburban rails in TMR are connected with down-town subway lines with seamless manner. And suburban trains run directly into subway tracks, and vice-versa. The through-service provides very convenient and speedy commutation for suburban dwellers.

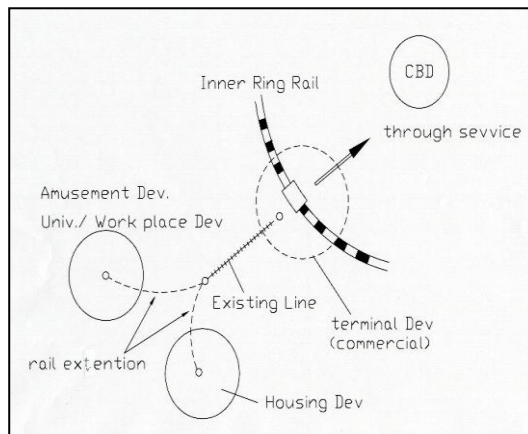


Figure 3-1 Coordination strategy

The coordination strategy serves not only as an urban transport policy, but also as a business model for suburban rail companies. Actually nine major private rail companies (except for Japan Railway East; a part of the former Japan National Railway) in TMR rely heavily on non-rail revenue, including real estate and advertisement. Some 30-50 percent of their total revenue comes from non-rail revenue. Real estate business strengthens financial base of private rail companies, and enables further investment in rail sector.

The coordination strategy had been inherited throughout the 20th century in Japan. The initial practice of the strategy can be traced back to the years of 1910. A suburban rail company in the Osaka Metropolitan Region, the second largest in Japan, developed a housing estate, located some 20 km away from the center. Right after the opening of its

rail extension, 200 houses in the 11 ha estate were sold out with its lots. For those who settled in, it meant a new life style, i.e. greenery and healthy suburban life with comfortable commutation by a new rail.

Since 20's, this business model had widely been adopted by the other private rail companies in the other metropolitan regions. And the business model had survived for more than 80 years, since then. By the end of the 20th century, total area developed by the nine major private companies amounts to some 15,000 ha in TMR. The former Japan National Railway, however, had not practiced such strategy, because real-estate business was out of its operational scope as set by the JNR law.

The coordination strategy had long been supported by the public sector by various means. Support from the national rail authority includes (i) licensing of exclusive franchise for rail operation in a certain corridor, (ii) provision of low-interest loan for suburban rail improvement. Local city planning authorities provides support by (i) issuing development permit, and (ii) authorizing land-use plans and effectuating building control, in favor of the strategy. The public sector itself shared the same strategy, and developed by itself large-scale new towns coupled with new rail construction and operation.

The largest-scale application of the business model was the Tama Garden City (TGC) Project in TMR. TGC is located at the south-western suburbs as marked by a red circle in Figure2-7. And its development corridor extends from 20 km to 35 km from the central Tokyo, as shown in Figure3-2. The development master plan of TGC is summarized as follows. The total area was 5,000 ha. The goal of development was amenity conscious-residential dev., including universities and famous private high-schools, with the planned population of 400 thousands. The planner was the Tokyu Corporation, one of the leading private rail companies in TMR.



Figure3-2 Location of Tama Garden City (TGC)

The initial step was to purchase of land by the Tokyu Co. started in 1953. The Tokyu purchased 20% of land from each land owners, in the project site. By doing so, The Tokyu persuaded the land owners to join into the development unions, organized by the Tokyu. A consideration behind was to share development benefit among land owners and the Tokyu Co. The rail extension route was finalized in 1963, so as to connect and penetrate agreed development areas along the project corridor as shown in Figure3-3.

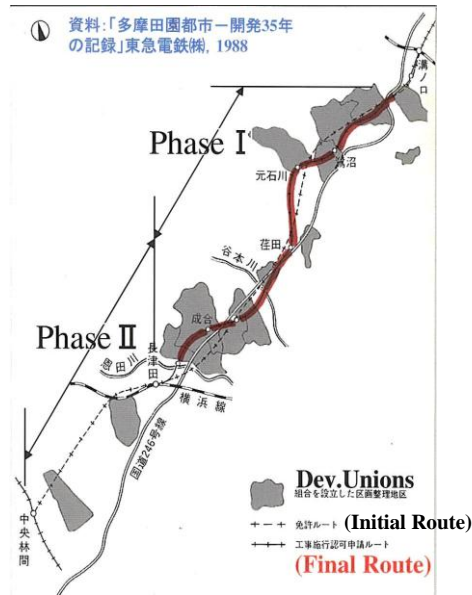


Figure 3-3 Dev. union and change in rail extension route

The planned development by unions in the project corridor amounted to 3,100 ha, i.e. 63% of the project area. In more than 90 percent of the planned development areas, development plans were implemented or agreed, prior to the completion of rail extension works.

The Photo 3-1 shows implementation of land development and rail extension works. On the left, shown are a railway tunnel, extended rail track basement, and a station structure. And in front of the station, the shape of a station plaza for modal change can be identified.

Site development



Rail extension

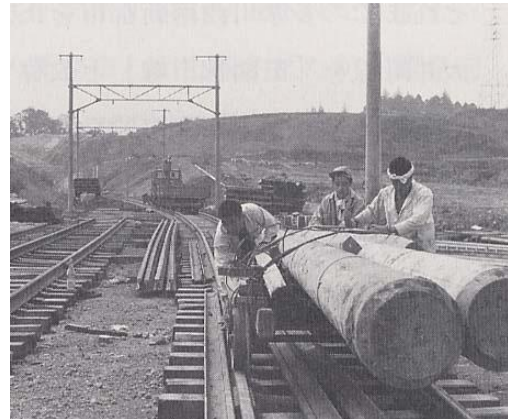


Photo 3-1 Implementing dev. and rail extension

In line with the development of TGC, considerable renovation of rail system was implemented. The Tokyu rail system related to TGC, before development, was just shown in Figure 3-4. The TGC project corridor is on the rail extension of the Ohimachi line, which is not a direct rail route to CBD, but still was a trunk rail route. Up to Shibuya from CBD,

the Subway NO.3 was in operation. However, connection between Shibuya and Futago was just an old tram line.

<ul style="list-style-type: none"> – Rail Extension (Ohimachi Line) Track gauge : 1,067mm Power collect : overhead
<ul style="list-style-type: none"> – Tokyu tram (1,372mm)
<ul style="list-style-type: none"> – Subway NO.3 Track gauge : 1,435mm Power collect : third rail

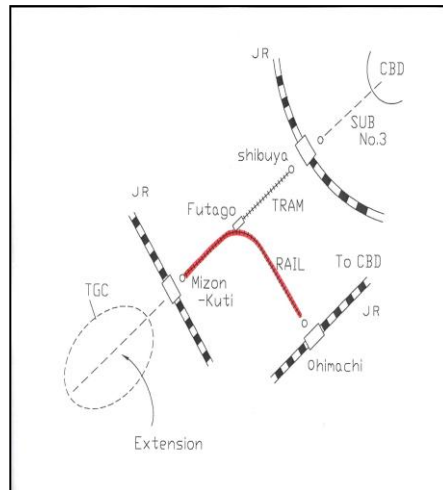


Figure 3-4 Rail system before TGC dev.

As the TGC development progressed, the Tokyu rail system had drastically changed as shown in Figure 3-5. The tram was replaced by a new underground Tokyu line, which was directly connected with a newly constructed Subway NO. 11, enabling through-service to CBD. The former Ohimachi line became a branch rail line. In the end, the commuters in TGC have been enjoying seamless through-service to CBD.

<ul style="list-style-type: none"> – Tram replaced by new Tokyu subway (8.8km) Track gauge: 1,067mm Power collect: overhead
<ul style="list-style-type: none"> – Subway NO.11 (new) (Gauge / Power: as above)
<ul style="list-style-type: none"> – Through service to CBD from TGC, enabled

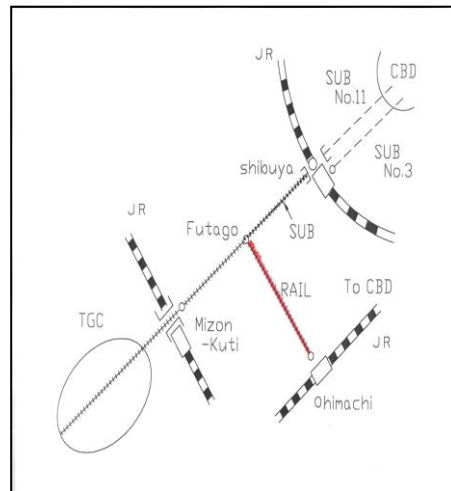


Figure 3-5 Through service to CBD after TGC dev.

The Figure 3-6 shows the trend of increasing population in TGC. The points (A) to (E) indicate the epoch of development. In 1963, when the rail extension commenced (B), the population in TGC was just about 30 thousands. In 1979, when through rail service was provided (D), the population had grown up to about 250 thousands. In 1984, the population reached to about 380 thousands, as initially aimed at in the master plan announced in 1956.

1956 : Master plan announced	(A)
1963 : Rail extension started	(B)
1966 : Phase I extension completed	(C)
1979 : Through service to CBD	(D)
1984 : Extension completed	(E)

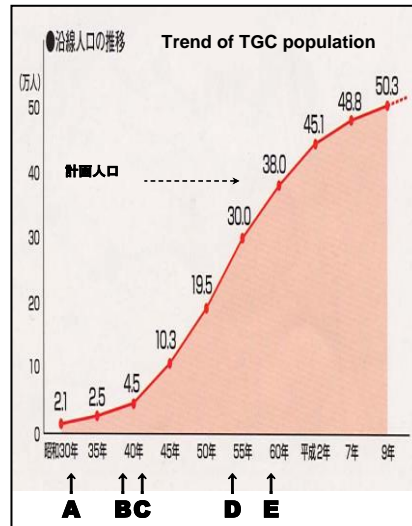


Figure 3-6 Trend of TGC population

The Photo 3-2 shows the views of TGC, after development. More particularly, this is the present scene around the same station (under construction) on the Photo 3-1. The TGC project has been highly reputed, and its population continues to grow even right now.



Photo 3-2 View of TGC (1984)

Two points can be raised as positive evaluation of the coordination strategy. Firstly, the strategy worked well as an urban policy including urban transport. The strategy enabled accommodating in-flowing population, and providing efficient rail service. And, as a result, Tokyo has avoided over-dependence upon motor-traffic. Secondly, the strategy worked well as a business model. The strategy contributed to expand revenue base, and enabled to provide fund for further rail investment from real estate sector. It should be noted, however, the success of the strategy was limited. Firstly, the strategy failed to cover all of the urbanized areas in Phase II. Vast suburban areas were left as sprawled. Secondly, greens and natures have been encroached to a great extent. Those two points were the other side of the coin, called “the coordination strategy”.

4. CONCLUSIVE REMARKS

The fundamental question raised at the beginning was “why rail transport is highly utilized in TMR.” Three points can be raised as answers extracted from the above. The two out of the three points are regarding the relationship between urbanization and provision of rail infrastructure. The first is a timely and pioneering efforts for rail network building by the end of Phase I urbanization. Phase I urbanization was moderate and expansion of densely inhabited areas was limited to the peripheries of central part of Tokyo. The second is an improvement efforts of existing rail network in the period of Phase II urbanization. As the phase II urbanization was sizable and rapid, densely inhabited areas had expanded along rail corridors. The increased transport capacity of the improved rail network had worked well to support huge demand of commutation between suburbs and center.

And thirdly, an explicit coordination strategy had been implemented, combining planning and finance of rail extension/new stations and suburban development, throughout the period of Phase I and II urbanization. The key concept of the coordination strategy is to exploit development benefit and to share it among private rail companies and suburban land owners. Profit from real estate business enables private rail companies to invest for further rail extension or improvement, and for further suburban development. The coordination strategy had worked well in large metropolitan regions in Japan throughout the 20th century, when trend of urbanization continued and suburban land price continued to increase. The coordination strategy worked (i) as a part of official urban transport and urban development policy, and (ii) as a business model for private rail companies.