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Tokyo Metropolitan Rail Network Long-Range Plan for the 21st Century

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Abstract: This paper is intended to introduce details of the master plan for the urban railway network in the Tokyo metropolitan area indicated by the Council for Transport Policy on January 27, 2000. In Section 2, we introduce the history of urban railway planning in the Tokyo metropolitan area together with policy issues at various times. In Section 3, we explain about subjects related to studies of this round of new railway development planning and their planning details. In Section 4 we wish to discuss the features of a traffic demand forecasting system that uses this planning. In Section 5 we explain about the introduction of new planned routes and the impact of their development. Section 6 is conclusion.

Keywords: urban rail network, long-range plan, congestion, travel forecasting method, probit model

1. Introduction

This paper is intended to introduce details of the master plan for the urban railway network in the Tokyo metropolitan area indicated by the Council for Transport Policy on January 27, 2000 and the system for forecasting travel demand that was used there. In the last fifty years, the urban railway network in the Tokyo metropolitan area has seen the development of 945 km, which has created a high density network even by world standards.

However there are many problems, such as congestion when commuters and students are traveling, as well as inconvenient access to Narita and Haneda airports and Shinkansen stations, and further development of the railways is expected. Meanwhile, with the advent of a reduced population and aging society, rising construction costs, restricted revenue due to the recent depression, railways investment and operating environment are facing very difficult situation.

A study of this new railways plan is considering the following points. Firstly, to maintain the diversity and consistency of the analysis, demand forecasting analysis, financial analysis, cost-benefit analysis and quantitative analysis of the effect of the development were made. Secondly, to reflect responsibility for efficient and effective implementation and administration of railway projects, cost-benefit analyses and quantitative and qualitative assessments were made of each route studied. Thirdly, with the variation and diversification of policy issues, we have made improvements positively to demand forecasting modeling, such as building a travel demand model related to trips for private and business purposes, building an airport and Shinkansen station access travel demand model and tackling demand modeling of congestion avoidance

behavior. Furthermore, based on the recent improvements in computing capacity, we have improved the precision of demand prediction by applications such as zone subdivision and disaggregate probit model.

In Section 2 below we introduce the history of urban railway planning in the Tokyo metropolitan area together with policy issues at various times. In Section 3, we explain about subjects related to studies of this round of new railway development planning and their planning details. In Section 4 we wish to discuss the features of a traffic demand forecasting system that uses this planning. In Section 5 we explain about the introduction of new planned routes and the impact of their development. Section 6 is conclusion.

2. History of urban railway planning in the Tokyo metropolitan area

Development planning for an urban railway network in the Tokyo metropolitan area began in 1925. At that time, streetcars were sustaining Tokyo's public transportation network. In concert with industrial development, the concentration of population and business functions in central Tokyo was advanced and the formation of the Keihin industrial belt in the same period applied the spur to population growth. The development of urban railways became necessary in order to respond to the increased demand for transportation caused by this expansion of the urban scale. The first government approved urban railway network plan (5 lines, 82.4 km) was published in 1925 in conjunction with plans for reconstruction after the great Kanto earthquake disaster of 1923.

After that, including the latest plan, there have been nine rounds of planning for an urban railway network in the Tokyo metropolitan area. We would like to present a brief outline of the main plans below.

The advancing concentration of business functions in central Tokyo and extension of the population into the suburbs in the 1950s generated a high volume of passenger demand from the suburbs to central Tokyo. These were the social circumstances under which the third round of planning for an urban railway network in the Tokyo metropolitan area was published in 1956. Direct reciprocal operation of subways and suburban railways for direct connections between suburban residential areas and the city center were indicated for the first time under this plan. The plan also indicated that transfer points were to be dispersed to ease congestion at junction stations.

This was a period of high growth for Japan and it was only six years after the 1956 plan that the planned routes were doubled in 1962 to cope with intensified congestion by commuters and students.

The extension of the population after that and increased demand by commuters and students continued, and long-distance commuting increased. The seventh plan was formulated in 1972 to cope with these issues calling for greatly strengthening the carrying capacity of radiating routes from the suburbs to the city center and faster running to reduce commuting times (by operating expresses, etc.) Routes that positively promote the Tokyo sub-center (Shinjuku) were also planned selectively. In addition, improved access to Shinkansen stations and airports would be provided to cope with the increases in inter-city and overseas travelers.

After that, the population increase in the Tokyo metropolitan area continued to increase beyond the predicted base. The areas of increasing population shifted from the southwest (Tokyo Tama and Kanagawa prefecture) towards the northeast (Saitama, Chiba and Ibaraki prefectures), new towns were developed and there was an urgent need to meet the commuter demand in those areas. Also, with the increasing numbers of overseas travelers, improving access to Narita airport and enhancing the accessibility of Haneda airport and the Shinkansen due to the expansion of business functions in core cities all over the country became issues. This was the background to the formulation in 1985 of the eighth railway network plan (567 km), which was aimed at the year 2000. This plan called for the development of routes to address the issues mentioned above as well as using existing routes more effectively by opening freight lines to passenger travel. A particular objective was to suppress the amount of congestion at peak times to no more than 180% by improving carrying capacity.

At as January 2000, about 250 km or 44% of the routes planned in 1985 are already in operation and work has started on another 170 km or 31%. The remaining 140 km or 25% has not yet been started. Accomplishing about 75% of the plan is an extremely high achievement. However, concerning estimates of the future population of the Tokyo metropolitan area, the fact that by comparison with the period of high economic growth the increase is slowing down and there is an obvious decrease in the night-time population of central Tokyo, it was predicted that the 1980 population of about 29.68 million for the whole of the Tokyo metropolitan area would increase by 14% to 33.70 million by 2000 but that estimate was already exceeded in 1995 when the actual population was 34.07 million, and it is clear that the estimates were too small, especially in Saitama and Kanagawa prefectures and Tama.

Therefore, (a) at this point of time, the targeted peak hour congestion rate of 180% will not be reached. In addition, issues such as the following remain for the present railway services. (b) The increasing exodus of the night-time population of the Tokyo metropolitan area is tending to increase the average commuting time of workers and students. Also, (c) on some routes, the number of operating trains is set close to the capacity of the line at peak times so that the standard speed of the trains is markedly decreased and recovery takes a long time in the case of an incident that disturbs the operation. (d) Train services are inadequate between core

business cities such as Yokohama, Tama, Omiya and Chiba and train travel is inconvenient in some areas. (e) There is a wide range of areas where convenient access to airports and Shinkansen stations has not been provided. (f) Many railway operators have formed networks and convenient on-travel between railway systems such as frequent transfer opportunities have not been provided. (g) There are delays in developing pleasant, trouble-free travel facilities for the aged and infirm.

Furthermore, with respect to the drive for development, (h) because of the already high-density use of land it is difficult to secure space for the introduction of new routes. Also, development costs are being increased by the complexity of station works, such as joining existing railways. (i) National and regional government funding is tight and increasing financial assistance is becoming difficult. (j) Achieving the plan is becoming difficult because the younging and aging of the community brings a sense of uncertainty about future demand, increasing the risk of investment and causing railways operators to lose the desire to invest.

3. Details of studies for a new future plan

Studies for planning a new railway network to address the above issues in 2015 were made and a plan was formulated in January 2000. Including the preliminary survey stage, three-and-a-half years were spent on the studies for this new plan. This is broadly divided into a period of study by the preliminary survey committee from June 1996 to April 1998 and a period of studying the formal future plan from November 1998 to January 2000 when questions were issued from the Minister for Transport to the Council for Transport Policy. Details of studies for the future plan from the aspect of demand forecasting analysis are shown in Figure 1.

In June 1996, the Ministry of Transport inaugurated the preliminary study committee for the formulation of a future plan for 2015. Naturally the members of this committee have become core members of the subsequent Council for Transport Policy.

The reason why the preliminary study committee was inaugurated before a formal study request by the Minister for Transport is a reflection of the considerable amount of time required to develop a demand forecasting system when the previous plan was formulated.

The main purposes of the preliminary study committee were to develop a demand forecasting system with respect to future social conditions and planning options, to extract routes from the routes preferred by regional governments and to understand the details of plans for land use, as well as to confirm the reaction of railway operators with respect to these preferred routes.

In response to these aims of the preliminary study, the Ministry of Transport conducted surveys by questionnaire and interview with respect to local governments and railway operators. The surveys for local governments included details of urban planning master plans, routes previously proposed that were now thought unlikely to make progress and why, routes preferred in the current future plan. The surveys for railway operators included conditions for operating a railway project and opinions about the routes preferred by local governments. Future route planning and urban planning proposals expected by local governments were arranged in accordance with these surveys.

In addition, planning changes such as routes where the small-scale development of an existing railroad would bring about a large effect, such as a wider area network to straddle local governments or eliminating a missing link, were added by proposals from committee members. It is now at its biggest as a future network of routes and one of the major roles of the preliminary study is to order these proposals to some extent.

After the inauguration of the preliminary study committee, while the above hearings continued, the various factors of the demand forecasting system were studied until December 1996. The points for the improvement of the demand forecasting system took measures to cope with the high density railway network, a response to demographic changes in the population such as younging and aging, the analysis of variations in demand trends with the growth of core business cities and the analysis of the demand for airport access. Studies included the application of probit model to route choice modeling, as well as the expansion of trip purpose as an object for analysis, and were submitted to the committee. Having been approved by the committee, studies of future population frames and the development of demand forecasting models were promoted for the space of about half a year from January 1997. In June 1997 calculations of trip distribution volume were being shown by the committee. After this, studies were being promoted such as improving the current reproducibility of demand forecasting models (to keep link volume errors within ±10%) and sensitivity analyses. In December 1997 the demand forecasting models were practically settled and in March 1998 the stage had been reached where transportation densities for routes and congestion ratios for routes between stations were being calculated.

In November 1998 the Minister for Transport questioned the Council for Transport Policy about the 2015 railway network development in the Tokyo metropolitan area and future railway network planning was formally studied by regional transport subcouncil. Subcommittees were established as the organization subordinate to the subcouncil and from December, the subcommittees were conducting interview surveys with regional governments and interview surveys with railway operators. Up to February 1999 routes preferred by regional governments and railway operators' improvement plans were rearranged. After that,

from March 1999, the survey was extended as an interview with users to four organizations: The Tokyo Consumers Association Liaison Center, The Federation of Tokyo Clubs for the Aged, The Japan Federation of Associations for the Disabled, and The Japanese Trade Union Confederation. Also, the Ministry of Transport gained 219 opinions from users by using the Internet and facsimile.

Detailed studies of variations in future demand due to the following five changes in social circumstances were conducted with respect to the demand forecasting system. 1) the development of downtown residence associated with a drop in land prices in the city center, 2) the advance of younging/aging, 3) the launching of women into society, 4) the increase of people applying flextime, 5) the development of telecommuting. Some alterations were made to the demand forecasting system as a result of studying these five points and the improved system was used to make future demand predictions.

Based on comments from relevant bodies and future demand prospects, the Council raised the following plan objectives:

- Easing congestion: To reduce peak period congestion ratios from 183% to 150% of 1995 in specified sections of main routes and below 180% in individual routes. Also, to substantially shorten the lengths of sections with more than 180% congestion.

- Express improvement: To develop wide area express networks not only with the city center but between sub-centers and between business core. Also, to improve standard speed at peak times and to develop wider area express traffic axes passing through central Tokyo.

- Response to redevelopment of urban structure and function: To build dispersed network structures in response to the reorganization of bay areas and urban redevelopment around key stations.

- Strengthen functional access to airports and Shinkansen stations: To strengthen access to Narita and Haneda airports and Tokyo and Shinyokohama Shinkansen stations as well as Shinagawa new station, which will be provided in 2003.

- Barrier-free: To ensure EV, ES, ticket vending machines, guidance information, wheel-chair space in carriages for the disabled and develop platforms with adequate width. With respect to reciprocity between railways and between railways and other modes of transportation, to promote mutual through travel, development of station plazas, modification of calculating comparatively expensive railway transfer fares, introduction of common cards for trains and buses and the provision of information such

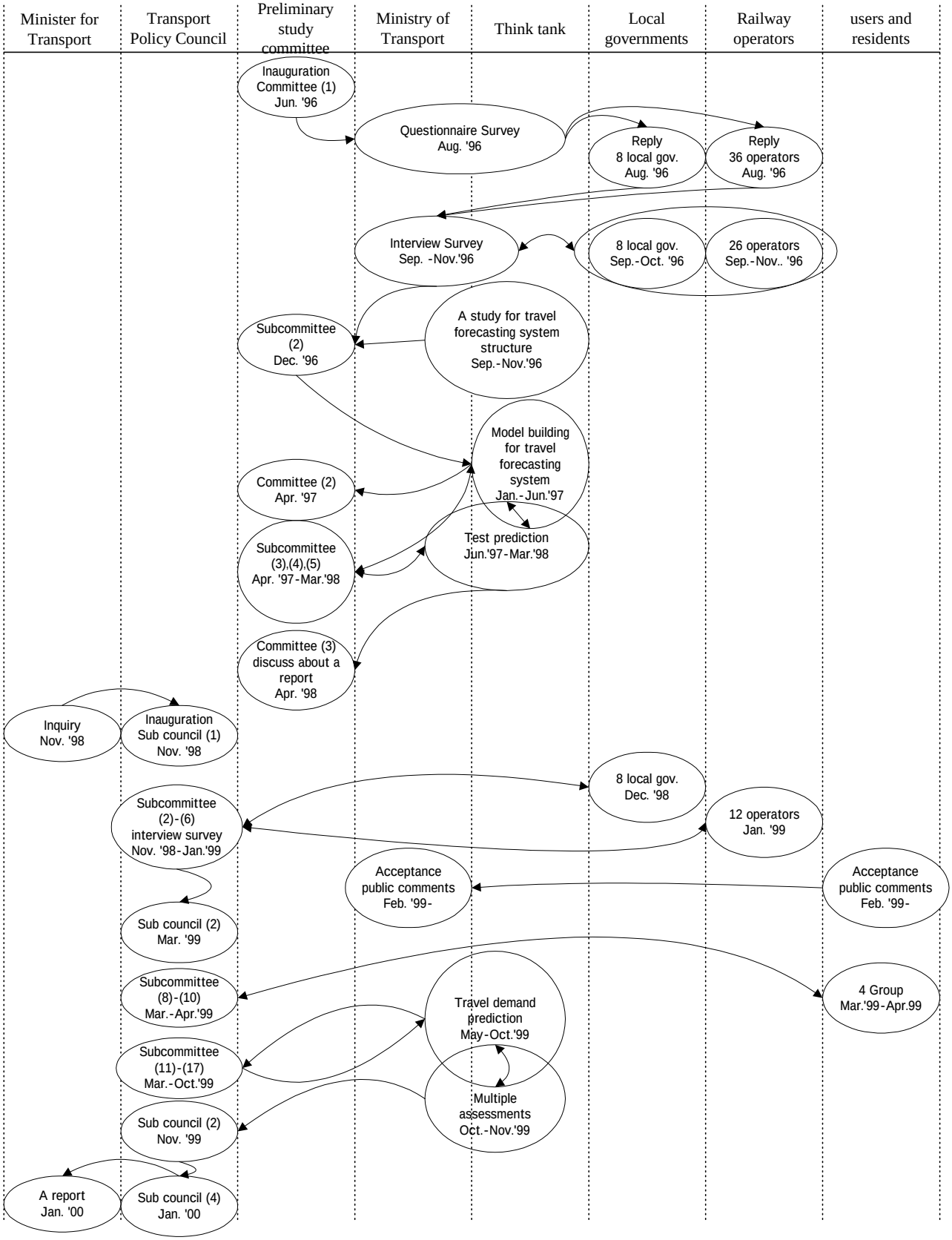
as guidance on transferring to other lines.

- Because of the need to have effective and selective investment that responds appropriately to transportation demand trends and social needs, to smoothly advance routes under construction. To extend existing routes and develop short-cuts as a means of utilizing existing stock and to promote the use of freight rail lines.

Assessments of planned routes based on demand forecasting analysis were carried out up to November 1999. For each route, transportation density, rate of congestion and length of congested sections were analyzed, and profitability and cost-benefit analyses were implemented. In addition, based on these quantitative analyses, each route was evaluated with respect to the objectives of the plan were made from five aspects: (a) relief of congestion, (b) more convenient transfers to other lines, (c) express improvement, (d) response to reorganization and redevelopment of urban structure and function, and response to areas with inconvenient rail services, (e) improved access to inter-city transportation. In addition to this, assessments were also made of competitive relationships or networking effects between existing lines and routes being developed. The proposed future plan was studied on the basis of these effects in order to select the routes preferred by local government and the routes proposed by the committee. The proposed future plan has three divisions: (A1) routes where development will be completed by 2015, (A2) routes where work will be started by 2015, (B) routes where a further feasibility study will be implemented by 2015.

Routes planned on the basis of the results of these analyses were summarized as draft findings by January 19, 2000 and after passing resolution by the Council, were submitted to the Minister for Transport on January 27.

Figure 1. Details of studies for a new future plan



4. Travel demand forecasting method

The four-step estimation method is used for travel demand forecasting but various devices are being used to evaluate planning options for addressing the issues peculiar to urban railways in the Tokyo metropolitan area that were discussed in Section 2 and the planning objectives that were discussed in Section 3. For example, zone sizes are made small in order to cope with the dense railway network and structured probit model is being used in consideration of the similarity of the railway routes to be used. The effect of easing congestion can be estimated by entering the lengths and congestion ratios of congested sections as variables in the course selection model. Models are also available for predicting traffic access to airports and Shinkansen stations. Below, after discussing the framework of the transport demand forecasting method, we wish to show the features of individual models.

Travel forecasting system structure

There are two broad classes of transport demand forecasting models. One is a group of models for handling trips by commuters and students and for business and private purposes, which are transport movements completed within the Tokyo metropolitan area. The other is a group of models for handling inter-city transport access trips between cities to airports and Shinkansen stations.

For the former group, after estimating the future population frame, separate railway demands for a whole day are predicted for each purpose, commuting to work and to school, business and private purposes, using the four-step estimation method. For the latter group, on the basis of the predicted values of future demands for Narita and Haneda airports and Shinkansen stations, separate railway demands for a whole day are predicted for business and private trips using the four-step estimation method. The total of former and latter transport demands for all purposes for the whole day becomes the transport demand. The congestion rate is calculated by first multiplying the peak ratio by the all-day volume of traffic in a section between stations to find the peak hour traffic volume of the section, then divide this by the transportation capacity.

Zones sizes

Target areas for demand prediction are Tokyo, Kanagawa, Saitama, Chiba and the southern part of Ibaraki prefectures. In order to improve the accuracy of the predictions, zoning has split the target areas into 1812 zones by taking into consideration factors such as the density of the railway network, zone of influence of the station, population and topography.

Trip production and attraction models

The generation and concentration of traffic volume for each travel purpose is estimated using the basic unit method (trip rate).

Trip distribution model

Basically, distributed traffic volume is estimated using Frator method but gravity modeling is applied in areas of new large-scale urban development.

Mode choice model

For the volume of traffic for each mode of transportation, we first prepared modal share curves for walking, bicycle and the main modes of transportation (train, bus, car) then we prepared two types of OD tables, for walking and bicycle and for the main transportation modes. Then we prepared OD tables for train, bus and car using disaggregate multinomial logit model of the latter OD table.

Railway route choice model

The Tokyo metropolitan area railway network has a very high density and it was assumed that the number of routes that could be selected in future planning would increase due to new short section route developments caused by the removal of missing links. Disaggregate logit models having IIA property were used in previous planning but, thinking that similarities between choose routes would be high, we applied disaggregate probit model to the future plan. These models are in accordance with the structural probit modeling of Yai et al (1997). We were also worried that probit model would take an enormous amount of time to calculate the probability of selection but by using the GHK recursive simulator this took only four times as long as logit model.

Another feature is the introduction of a congestion ratio index as an explanatory variable as shown in Table 1, which provides a point that enables the behavior of users avoiding routes with high congestion ratios to be analyzed. This index has become a variable that indicates increasing resistance of users with increasing congestion ratios or longer congested sections.

Inter-city transportation (airports and Shinkansen) access demand models

We constructed a system for predicting the demand for transportation to access Narita and Haneda airports and Shinkansen stations, with separate four-step estimation models. The purpose of a trip was either business or private. The number of airport users, which is the value of the volume to be generated in the future, was established on the basis of the 7^{th} airport development 7-year plan. The number of Shinkansen users was established by trend analysis. Transportation mode choice models and railway route selection models were

created by sampling data on airport users and Shinkansen users.

Estimating volumes of peak hour traffic

Peak hour sectional traffic volumes are estimated from all-day traffic volumes that are predicted with the above model groups. With this system, peak hour traffic volumes were estimated for each section by multiplying the peak rates that were established for each section and trip purpose by the all-day traffic volumes for each section and trip purpose. Peak rates for new routes are based on peak rates for similar existing routes. Also, future peak rates take account of reductions in the ratio of commuting and the ratio of commuting in peak periods due to the aging of society.

Table 1. Estimation results for multinomial railway route choice model

Trip purpose / Variable name	Coefficient estimate (t-statistic)			
	Home-to-work	Home-to-school	Private	Business
In vehicle time (min)	-0.0943	-0.0597	-0.0494	-0.0499
	(-8.1)	(-5.8)	(-2.9)	(-3.29)
Access and egress time (min)	-0.127		-0.0583	-0.0599
	(-11.7)		(-4.3)	(-5.82)
Access time (min)		-0.0691		
		(-6.2)		
Egress time (min)		-0.0603		
		(-5.7)		
Transfer time includes waiting time (min)	-0.112	-0.0793	-0.0722	-0.0687
	(-10.7)	(-8.7)	(-4.2)	(-4.52)
Total cost (yen)	-0.00200	-0.00388	-0.00233	-0.00103
	(-4.0)	(-7.1)	(-3.0)	(-1.57)
Congestion index*	-0.00869	-0.00177		
	(-3.34)	(-0.8)		
Ratio of two variances	0.436	0.161	0.513	0.214
	(2.7)	(1.4)	(1.2)	(1.06)
Likelihood ratio	0.390	0.331	0.172	0.156
Number of samples	1218	811	436	357

*The congestion index is defined by $congestion\ index = \sum_h \left(congestion\ rate_h^2 \times link\ travel\ time_h \right)$. The square of the congestion rate at link h multiplied by travel time of the link is summed up for all links on the route.

5. Assessment of future plans

Results of future population prediction

From the Tokyo Metropolitan Area Master Plan (November 1999), the future population for the whole of the subject area as at 2015 was taken to be 35.35 million. With this figure as a control total, populations were calculated in six categories: nighttime population, working population, employed population, student population, academic population, daytime population. The growth of population with new urban development is being estimated using curves built-up from planning values obtained from local governments. We are also predicting population in age groups for each gender so as to enable the effects of aging and younging and the effect of the entry of women into society to be evaluated.

Summarizing the results of our population estimates enables us to say as follows:

- The total nighttime population of the Tokyo metropolitan area will increase slightly. There will be little change in the working population but the student population will decline markedly with the effect of decrease in young population.

- Regionally, although the nighttime population will show a major drop in the Tokyo wards, we can see a 5 to 10% increase in all areas around the Tokyo wards and the outwards drift of the population is predicted to continue as before.

- For numbers of workers aged from 15 to 64, although the population of productive age will decline, we predict large increases in the numbers of aged and female workers that will alter the structural proportions of workers but the total number will not change.

Results of railway demand forecasting

The results of demand forecastings for 2015 are as follows.

- The trip generation in the Tokyo metropolitan area is from 88.81 million persons per day in 1995 to 89.21 million persons per day in 2015. Trip purposes account for a 3.9% increase in commuting, a 3.5% increase in private purposes and a decline of 21.4% in commuting to school. When these are removed, an overall increase of 0.5% remains.

- Within these figures, the rail traffic volume generated goes from 23.34 million persons per day in 1995 to 23.69 million persons per day in 2015, an increase of 1.5%. Trip purposes include a 6.7% increase in

commuting, 4.3% increase in business trips, no change in private purposes, a 25.2% decrease in school commuting and a 34.7% increase in accessing airports and Shinkansen stations.

- The railways' modal share is level at 26.3% in 1995 and 26.6% in 2015.

- The volume of traffic flowing in by rail to the city wards area shows a 5.6% increase from 4.58 million persons per day in 1995 to 4.84 million persons per day in 2015. When we look at their points of origin, whereas Tama and Kanagawa prefecture are up 1% or less, Saitama prefecture is up 11.1% and Chiba prefecture is up 6.3%.

- The numbers using the airports or Shinkansen stations are expected to increase in the future, the traffic volume accessing Haneda airport by rail will increase by 53% from 87,000 persons per day in 1995 to 133,000 persons per day in 2015 and the figures for Narita airport predict a 67% increase from 33,000 persons per day in 1995 to 55,000 persons per day in 2015. The volume of traffic accessing Shinkansen stations is expected to increase by 27% from 288,000 persons per day in 1995 to 366,000 persons per day in 2015.

- The decline in demand for rail travel due to the advance of telecommuting and flextime systems is expected to be extremely small.

Planned routes

Routes preferred by local government and routes proposed by the Committee were condensed on the basis of the above demand prediction results. Figure 2 shows the routes indicated as the new railway network as a result of assessments. Red lines are routes that are suitable for operation by the target year (A1). Orange lines are routes that are suitable for starting development by the target year (A2). Green broken lines are routes that must be developed or must be studied in future (B). The total length is 658 km. 206.2 km of A1 is already started and 81.8 km is new development. A2 is 166.8 km and B is 203.3 km.

Effects of planned routes

The effects of planned routes are summarized below.

- In 1998, the peak hour congestion rate in the Tokyo metropolitan area averaged 183% in the main sections. By 2015, the congestion rate will be 171% when the routes currently being developed are available and this is expected to drop to 151% when A1 and A2 become available. If we examine individual routes, there are only three JR East routes where congestion rates exceed 180% (Sobu line non-express, Tokaido line and Takasaki line).

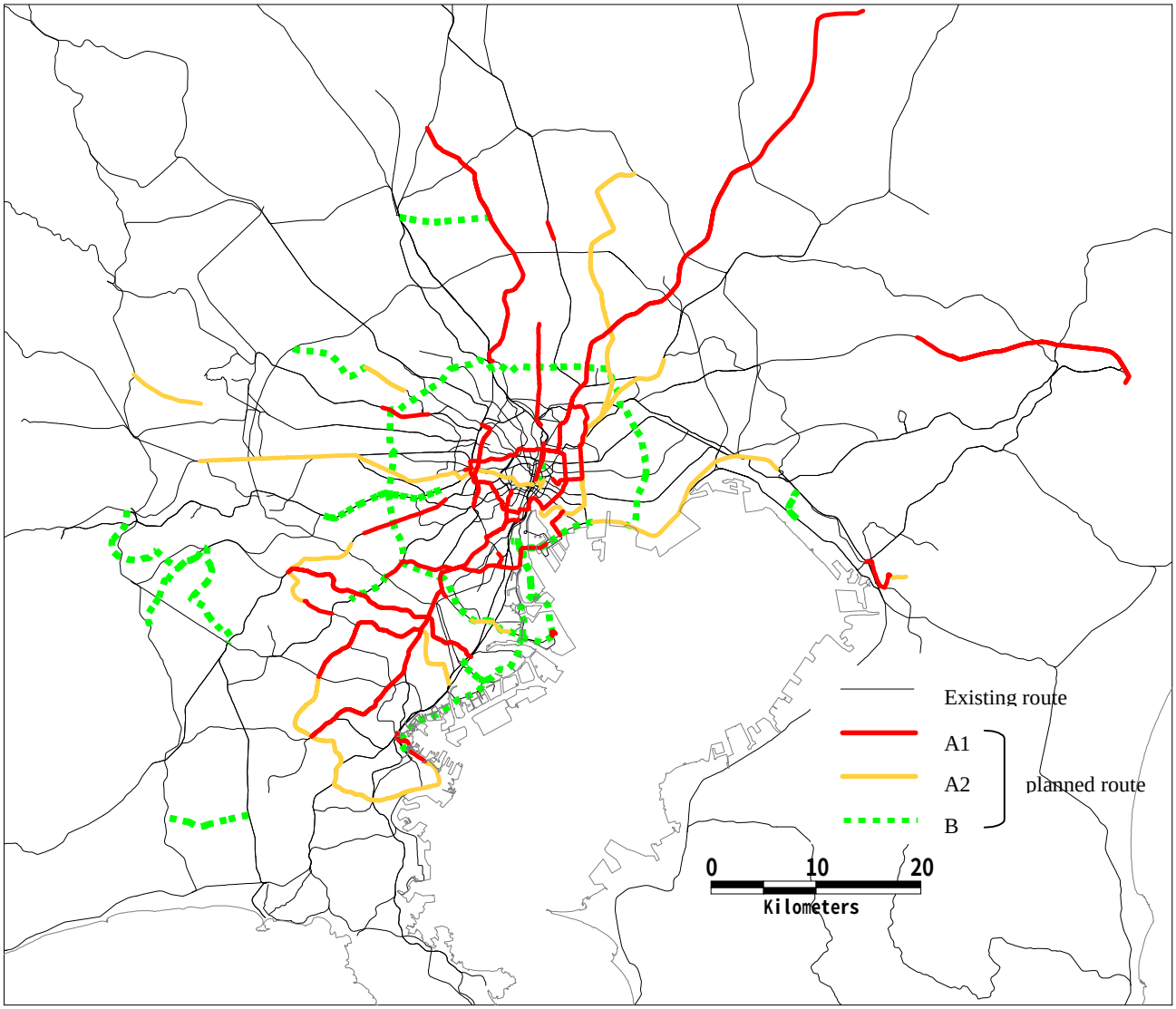


Figure2　Urban railway network master plan in the Tokyo metropolitan area

- For the lengths of congested sections, in 1998 there were 259 km of sections where congestion rates exceed 180% but this can be reduced to 49 km with the A1 and A2 developments.

- Reciprocal through traffic on routes joining business core cities will enable quicker travel between business cities and reduce the number of transfers. For example, Yokohama to Omiya now takes 75 minutes with two transfers but this will be shortened by 16 minutes with no transfers. Chiba to Hachioji will take 11 minutes less with no transfer. The formation of the Tokyo metropolitan area dispersed network structure is expected to contribute greatly with improvements such as these.

- On examining airport accessibility, firstly for Narita airport the time required between Ueno and Narita airport will be cut from 59 minutes to 47 minutes. From Omiya to Narita airport, which now takes 95 minutes, can be expected to be shortened by 12 minutes. For Haneda airport, the 40 minutes required from Tokyo station to Haneda airport will be shortened by 8 minutes with no transfer.

6. Conclusions

The appropriate implementation of the master plan for an urban railway network in the Tokyo metropolitan area will diversify future lifestyles, cope with the arrival of an aging society and provide a highly convenient urban transport system that is fitting for the Tokyo metropolitan area, which is a central international city. Bringing the plan to fruition will require the cooperation and collaboration of national and regional public bodies and railway operators.

At the present stage, since there are several cases of planned routes for which the prospective developers and operators are not yet clear, the Council for Transportation Policy is steadily advancing the plan by periodically conducting studies to follow up the status of progress with the development of planned routes. Points at issue in the steady advancement of the plan are summarized below.

- Recently, since there has been no prospect of large increase in the demand for transportation, and development are rising, railway operators are half-hearted about investment. Therefore, (a) there is a need to study ways of development that make use of PFI and vertical separation systems, and (b) to secure new funding with public assistance measures included.

- Construction costs are rising steeply due to problems of securing space the for introduction of new development and the complexity of station construction. Also, coordination between those involved in the construction processes takes time and causes delay in getting started. Therefore, (c) development costs will be reduced by suppressing excessive investment through the development of facilities that meet the demand for transportation such as small subways and development integrated with urban redevelopment works . (d) In order to shorten the construction period, mutual coordination between related organizations in various procedures such as urban planning and environmental impact assessments shall be more meticulous.

- For smoother railway development, in addition to the above, it is important to gain the understanding and cooperation of railway users and residents concerning the necessity for the development, details of the works, environmental measures and so on. Based on the need for public involvement, public comments

derived from the Internet and by fax were reflected in discusses by the Council for Transportation Policy. In the future also, (e) from the stage of drawing up draft plans for a railway development, it will be necessary to provide users and residents with information such as details of the development, and at the same time gain an understanding of users' needs, which must be reflected in the railway development.

- Sound management is indispensable in a railway project is order for the stable provision of good service by the railway operator. Therefore, a stable and appropriate demand for transportation is essential for railway transport. Accordingly, (f) before beginning the development, review the prospects for future demand and study profitability thoroughly. (g), In a case where revenue from a railway project will deteriorate due to delays in large scale urban redevelopment, the railway operator must liaise with the relevant organizations such as core city development bodies and relevant local governments with a view to tackling management improvements at an early stage. (h) Concerning fares, from the view that beneficiaries should bear some responsibility, studies such as peak load pricing are essential. (i) Concerning the third sector where business management is harsh, it is necessary to study the stable securing of project capital for the local public corporation that are contributors.

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