

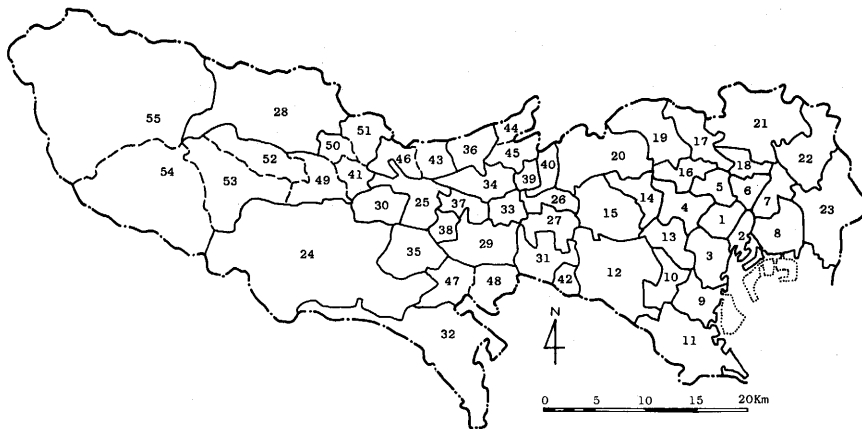
POSTWAR GROWTH OF TOKYO AND THE ARCHITECTONIC CHANGE OF ITS BUILT-UP AREA

Itsuki NAKABAYASHI

I. INCREASE OF POPULATION AND GROWTH OF URBAN AREA

Remarkable growth of Tokyo after the Meiji Revolution is well represented on its constant increase of population. Started from only 1,085,000 in 1880, it attained 2,732,000 in 1910, and had reached to 3,860,000 in 1923 when the Great Kanto Earthquake suddenly attacked this growing city. Its constant increase till today was intermitted at the two occasions; the first one in 1923 being brought by the destruction by the Kanto Great Earthquake and the second time in 1945 by the damage by the World War II. Only about the half of the population in 1932 remained in destroyed Tokyo in 1945, and the population of the city could not exceed again the maximum value in the prewar development till 1953. After then, conditions furnished by the rapid postwar growth of the national economy pulled into this metropolis the numerous new residents who were attracted by such factors as enlarging labor market, high income level, favored educational opportunity, and so on. Remarkable expansion of metropolitan suburbs was consequently resulted by this situation and it brought the decrease of inhabitants in its proper built-up area (*ku*-area, or properly Tokyo municipal area in statistical treatments) since 1965, and in the same time, the heavy increase of day-time population in the latter. Recently the increase ratio of population in the Greater Tokyo, (consisting of the four prefectures), too, failed on stagnation, being affected by the depression of the national economy at the international trouble of oil price problem in 1973. The wards area of Tokyo in 1975 holds 8,650,000 population, but the two wards (*Chiyoda-ku* and *Chuo-ku* : *ku* in Japanese administration system) within it have been decreasing their population since 1955, the six wards (*Minato-ku*, *Bunkyo-ku*, *Taito-ku*, *Sumida-ku*, *Shinagawa-ku*, and *Arakawa-ku*), since 1960, and finally all the wards has losing the population after 1980. Fig. 1 shows the location of *ku*, *shi*, *cho*, and *son* (these terms respectively indicate the type of administrative units within the Tokyo prefectural unit (*to*-area)).

Day-time population is still increasing in the wards area, being contrasted to the decrease of inhabitants. The day-time population in the wards area was 4,941,000 in 1930 and it was approximately equal to its inhabitants, 4,987,000 in that time. Day-time population in only four wards indicated greater value in comparison to the number of inhabitants; *Chiyoda-ku*, 177%, *Chuo-ku*, 132%, *Minato-ku*, 109% and *Bunkyo-ku*, 101%. It was in 1955 that Tokyo experienced the first time when its day-time population in the whole wards area, 7,323,000, mentionably exceeded the number of inhabitants, 6,969,000. Since then, discordance of the two values has become progressively larger towards recent years. The day-time population in the wards area, which amounted to 10,714,000 in total in 1975, was so unevenly



- | | | | |
|-----------------|-------------------|-------------------------|-------------------------|
| 1. Chiyoda-ku | 15. Suginami-ku | 29. Fuchu-shi | 43. Higashiyamato-shi |
| 2. Chuo-ku | 16. Toshima-ku | 30. Akishima-shi | 44. Kiyose-shi |
| 3. Minato-ku | 17. Kita-ku | 31. Chofu-shi | 45. Higashikurume-shi |
| 4. Shinjuku-ku | 18. Arakawa-ku | 32. Machida-shi | 46. Musashimurayama-shi |
| 5. Bunkyo-ku | 19. Itabashi-ku | 33. Koganei-shi | 47. Tama-shi |
| 6. Taitoh-ku | 20. Nerima-ku | 34. Kodaira-shi | 48. Inagi-shi |
| 7. Sumida-ku | 21. Adachi-ku | 35. Hino-shi | 49. Akikawa-shi |
| 8. Kohto-ku | 22. Katsushika-ku | 36. Higashimurayama-shi | 50. Hamura-cho |
| 9. Shinagawa-ku | 23. Edogawa-ku | 37. Kokubunji-shi | 51. Mizuho-cho |
| 10. Meguro-ku | 24. Hachiohji-shi | 38. Kunitachi-shi | 52. Hinode-cho |
| 11. Ohta-ku | 25. Tachikawa-shi | 39. Tanashi-shi | 53. Itsukaichi-cho |
| 12. Setagaya-ku | 26. Musashino-shi | 40. Hoya-shi | 54. Hinohara-son |
| 13. Shibuya-ku | 27. Mitaka-shi | 41. Fussa-shi | 55. Okutama-cho |
| 14. Nakano-ku | 28. Ohme-shi | 42. Komae-shi | |

1~23: *ku*-area (wards area)

1~10, 13, 14, 16, 18: inner *ku*-area

1~55: *to*-area (Tokyo Metropolis)

Fig. 1 Index map of administrative units

allocated that they exceeded the number of inhabitants to a great degree in the twelve wards; Chiyoda, 1,500% of the inhabitants, Chuo-ku, 700%, Minato-ku, 300%, Shinjuku-ku, 180%, and others.

The expansion of built-up area of Tokyo is fairly in response to its population increase as shown in Fig. 2. At the destruction by the Great Kanto Earthquake, about 312,000 houses were burnt off covering the area of 38.3 square kilometers as can be observed in the figure on 1923. This happening raised the first expansion of suburbs after then.

Far heavier damage was, however, brought by the bomb attack during the World War II, and the burnt area at this time spread on 156 square kilometers as viewed in the figure on 1945. The recovery from this destroyed built-up area had been carried on the first ten years after the war, and it was succeeded by the remarkable expansion in the period of the so-called "postwar growth of national economy in Japan". Fig. 3 shows the areal expansion of the Densely Inhabited District (DID) of Tokyo after 1960, based on the data source in the Population Census by Statistical Bureau of Ministry of Japan. DID is so defined as the

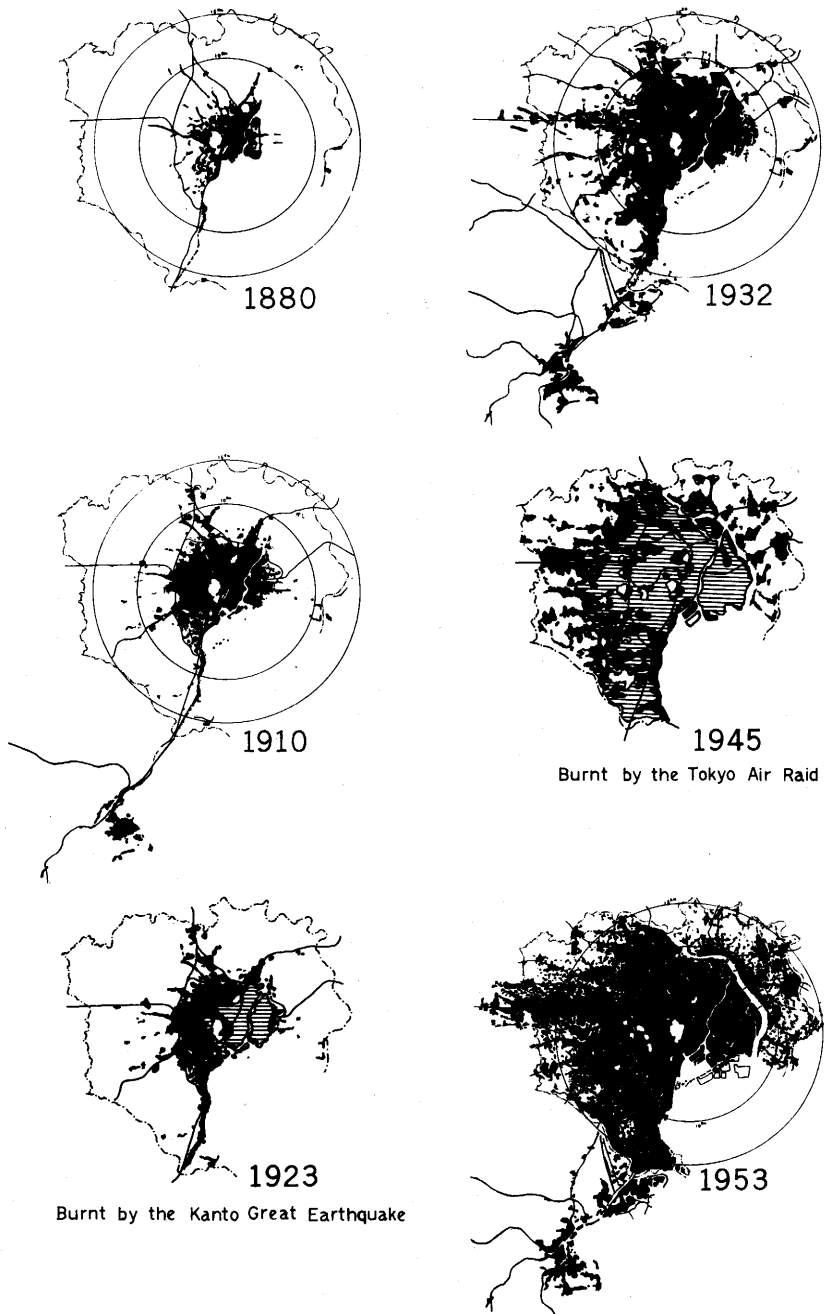


Fig. 2 Expansion of built-up area in Tokyo (1880–1953)

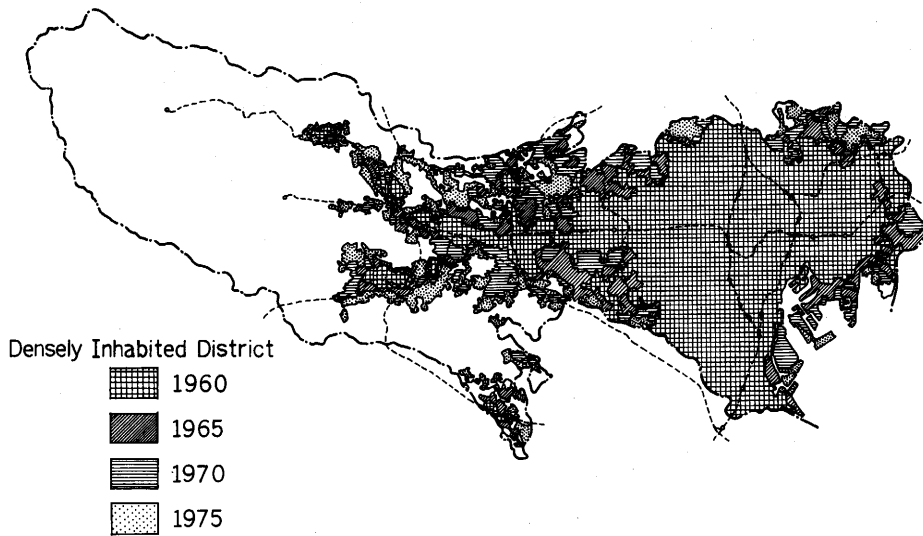


Fig. 3 Expansion of densely inhabited district of Tokyo (1960 – 1975)

unification of census tracts where population densities are more than 4000/km² and they contain respectively agglomerated population of over 5000. It can be observed in the figure that it began to expand westwards along the Chuo-line in 1960, and now it spread over to the peripheral part of the Tokyo metropolitan prefecture (*to*-area), excluding mountain land and a part of hill land. DID of Tokyo expanded from 467 km² in 1960 to 577 km² in 1975 in regard of the wards area, and from 571 km² to 1492 km² including suburbs (in the *to*-area).

II. CITY PLANNING OF TOKYO

The purpose of the establishment of the Postwar Tokyo Reconstruction Master Plan, offered by municipal office in 1946, was to reject over-concentration of population and functions into Tokyo. It designed the upper limit of the population in the *ku*-area to be 3,500,000 and the size of its built-up area to be less than 335 km² at largest. But the actual postwar reconstruction in Tokyo metropolis had overpassed this ideal limitation in a few years. In 1950, the Law of the National Capital Construction Act was established, on the purpose to regulate these disarranged expansions of Tokyo at the national law. This national project was, however, not forcible enough to remove the tendency of the built-up area of Tokyo to spread out its suburbs, because the applied area of it was limited only in the administrative area of Tokyo metropolitan government.

The National Law of Capital Region Development Plan enforced in 1956 aimed at regulating the outer expansion of Tokyo built-up area by providing the circumscribing *suburban green belt area* of about 10–15 km in width. But unexpected speedy expansion of built-up area soon began to invade the green belt in ideal plan, because of the incomple-

tions of the law to practically control the new housing. Therefore, the Law of Capital Region Development Plan was forced to be amended in 1965. The revised law abolished the idea of the green belt plan, and the idea was altered into the planning idea of the foundation of the legally designated *suburban development areas* to accommodate the new expansion. Successful maturing of these areas was expected to save the formerly planned green belt areas from disordered invasion by urban areas, and these urban development areas were laid on the planning map in the three manners; the inner *urban development area*, designating the *ku*-area together with the two cities of Musashino-*shi* and Mitaka-*shi*, and the outer *Satellite Town development zone* linked with the ready established independent cities around Tokyo. They were planned to be separated from each other with the *suburban development areas*.

Prior to the enforcement of the Law of Capital Region Development Plan, the law of City Planning Act had been established in 1919, and the idea of *land use zoning* of built-up area was adopted in it as one of the most fundamental procedures in city planning.

This law was entirely revised in 1968 to be adjusted to the new situations of urban lands which were filled up with various urban problems caused by their speedy expansion after 1955. This new law of City Planning Act introduced the idea of distinction of the *building up promotion area* and *building up control area*, aiming to acquire the new strategy to control the severe competition of diversified demands on land use and as well to accomplish the rationalization of effective land use zoning. Local governments have to push forward the planned urbanization in the building up promotion area through the means of proclamation of land use zoning plan on about ten years and foundational readjustment plan of public facilities such as roads and streets. On the contrary, any type of urbanization plan in the building up control area could not be admitted by local governments in principle to reject disarranged expansion of urban land use.

The final planning map based on this new law was published by the Tokyo Metropolitan Government in 1970, and its designated building up promotion area was approximately coincident to DID of Tokyo in 1975 adding some smaller adjacent areas to it. Main procedure to realize the land use zoning plan in this act was, viewed from the result, not promotion act but regulating act in coupling to the law of the Building Regulation Act partly revised in 1970. By the latter the metropolitan government can controled, in every zone of designated land use type, such elements of land use as usage of newly constructed building, limits of building rate (rates of occupation space of building to construction yard), limits of capacity rate (rates of total floor space of building to construction yard), and the like. The land use type was classified into eight types. Final land use zoning plan was, on a planning idea unifying these new laws, established in 1973 by Tokyo Metropolitan Government.

Notwithstanding all these efforts to promote planned urbanization, the effects of the regulation could not always satisfy the initial expectations because of the default of these laws in their practical regulation manners.

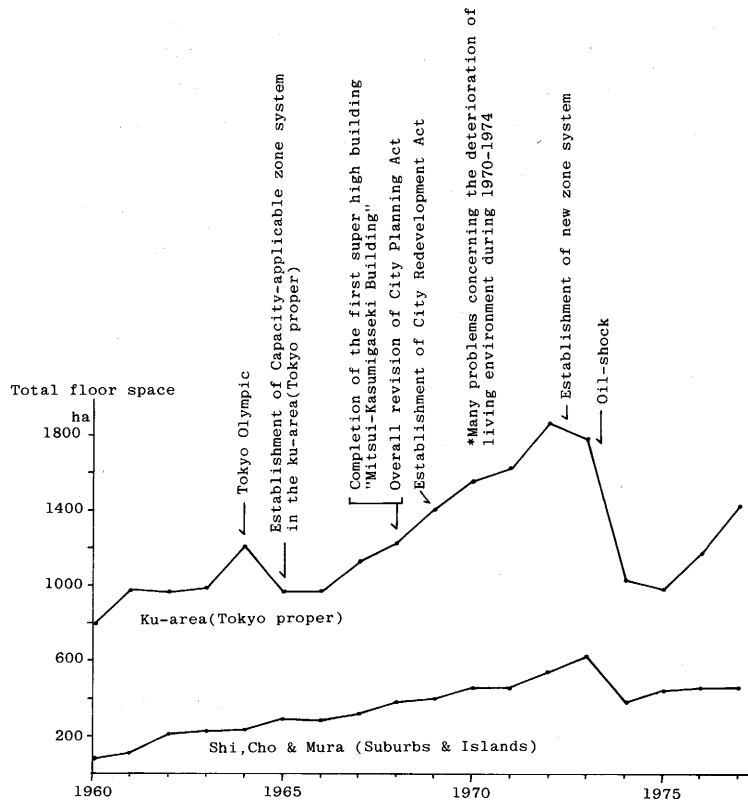


Fig. 5 Annual changes in total floor space of newly constructed buildings by usage

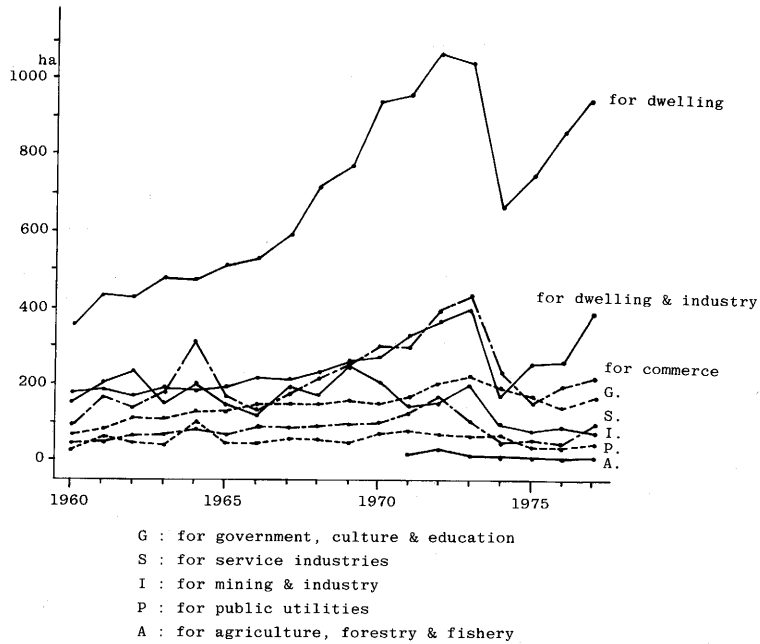


Fig. 4 Annual changes in total floor space of newly constructed buildings by area

III. TENDENCY OF BUILDING CONSTRUCTION IN THE POSTWAR DEVELOPMENT OF TOKYO

Fig. 4 shows the annual change of total floor space of newly constructed buildings in *ku*-area and the other area of Tokyo since 1960, and the composition of their usage types is exhibited in Fig. 5. Total floor space of newly constructed buildings was estimated at about 1,000ha a year in the *ku*-area in average in the earlier half of the 1960's, and the values enlarged remarkably after 1966 till 1974 when the rapid economic growth of Japan turned to stagnation. The designation of land use type of vacant lot (green belt conception) was abolished in law in 1965, on severe impacts of urbanization. Then the regulations by the combination of the limits of building rate and of capacity rate became to be separately applied on each type of land use zone in the *ku*-area, instead of the combination of the limits of building rate and of building height. As a result, efficiency of land resources utilization was heaved up by the construction of multi-stories buildings. These changes in law undoubtedly caused the rushing on new building construction especially on the construction of multi-stories buildings for the use of offices and apartment residential houses. Total floor space of newly constructed buildings amounted to 1,800ha in 1976, and it was nearly twice larger than that in 1965. More recently, the demand on new construction of buildings has reduced after 1976 by decline of national economy. But the new construction has still increased even after then, though both of the land price and construction cost has unreasonably elevated. The new buildings in this period were used; at first, for dwelling, the next, for commerce, and the third, for combined use of dwelling and jobs.

In comparison to the increase rate of new buildings in the *ku*-area, far larger increase rate of that in suburban areas (*shi*, *cho*, and *son*) was brought in these periods. Total floor space of newly constructed buildings in suburban areas increased from 100ha in 1960 to 620ha in 1973, and most of their new buildings are used exclusively for dwelling. Creation of new DID as shown in Fig. 3 is one of its results.

IV. RECENT CHANGES IN BUILT-UP AREA

Growth of the city as above described raised in every division within built-up area the memorable change of such situations as land use types, population densities, or building densities. Fig. 6 exhibits the chronological change of areal distribution with regard to capacity ratios (rate of total floor space of buildings to area of housing land; actually, the values are calculated by statistical data source on buildings privately owned). This indicator can be suitable enough for measuring vertically simulated building density of built-up area or net density of buildings to housing lands. Capacity ratio in the wards within built-up area of Tokyo started from the range more or less near 100% at their highest values in 1953, when the recovering from the war damage mostly accomplished; that is, Chuo-*ku*, 114%, Chiyoda-*ku*, 86%, and Taito-*ku*, 69%. Only slight increase can be observed on these values till 1958, at which postwar growth of Japanese economy just began to flourish; that is, Chuo-*ku*, 144%, Chiyoda-*ku*, 112%, and Taito-*ku*, 88%. These three wards had sharply shaped the central business district till that time, and the increase of capacity ratio in this

period can be observed restrictedly in these wards and some surrounding wards.

Increase of capacity ratio in Tokyo, too, began to start after then, in accordance with the population growth of this city. Its notable upheaving spread over almost all of the wards till 1965, keeping the clear increasing core on the CBD. Furthermore, the amendments of City Planning Act in 1965 and 1968 produced not only the increase of construction of new buildings above discribed but the noteworthy upheaving of capacity ratio in the built-up

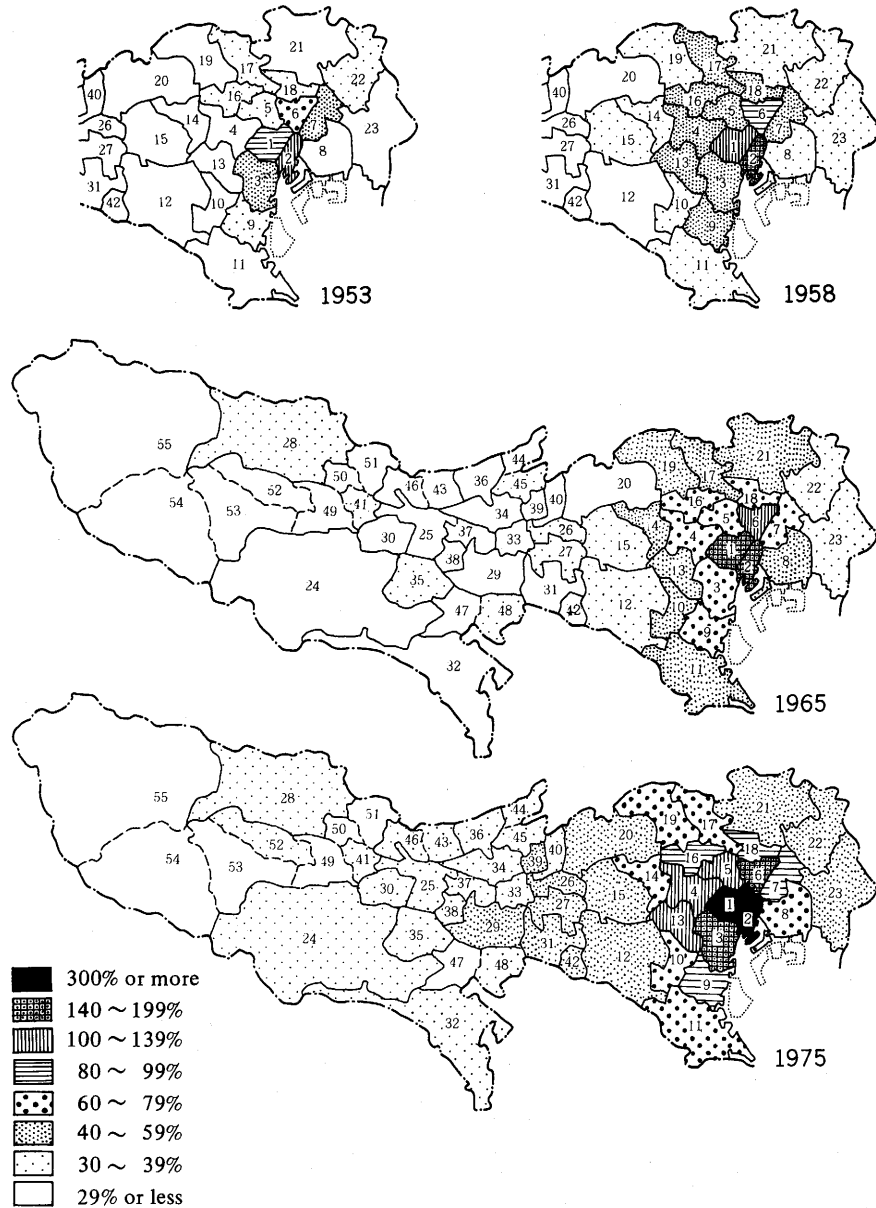


Fig. 6 Areal distribution of capacity ratios in each year

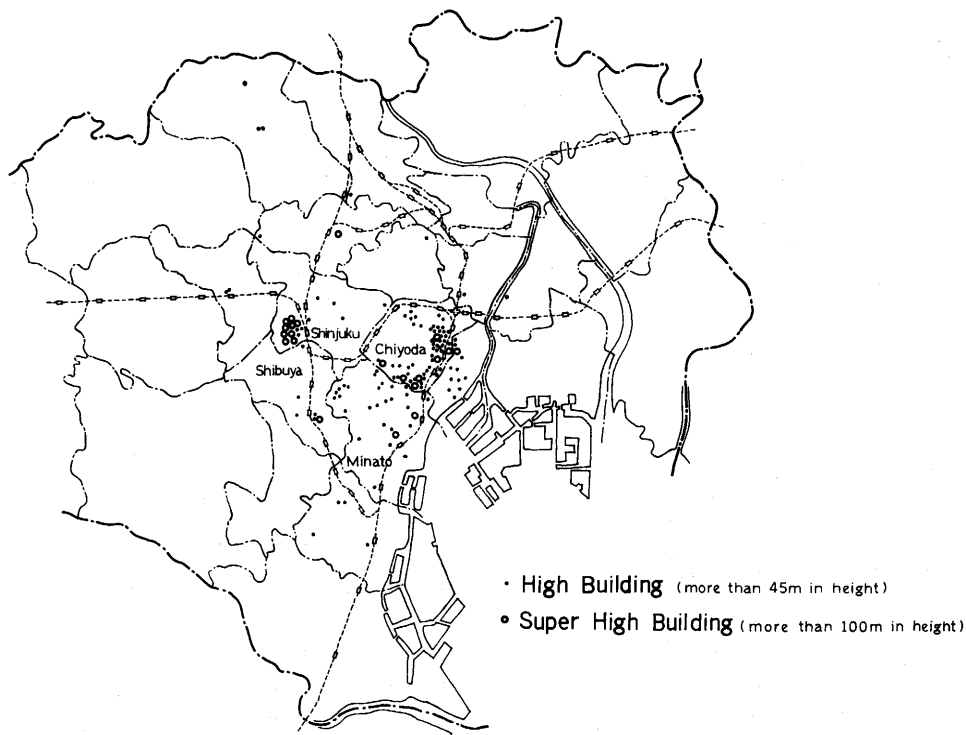
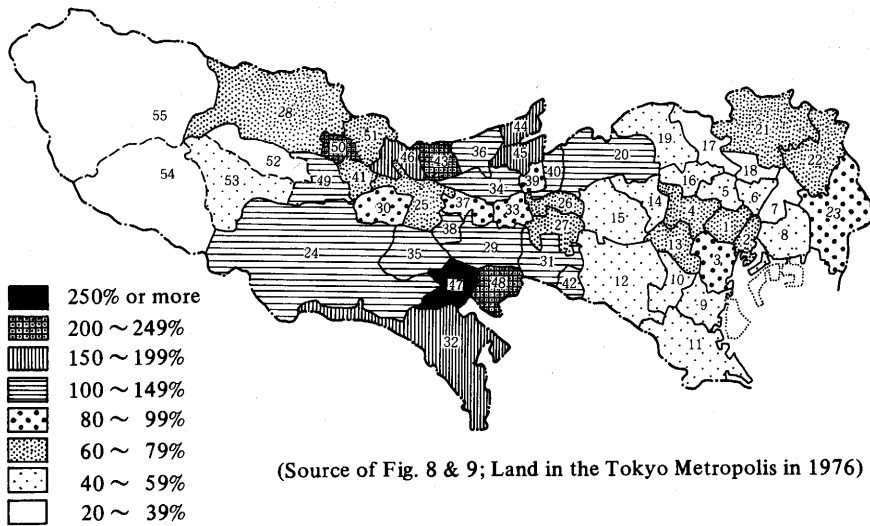


Fig. 7 Distribution of buildings more than 45 m in height in 1978

area. It is obvious that the former change affected the latter change, but, in addition to it, the animate reconstruction of buildings from low-stories to higher one much promoted the latter change in this period especially in the CBD of the city. Perhaps this vertical expansion of CBD was directly affected by the fact that the regulation procedure of building height limits was replaced by that of capacity ratio limits at the amendment of City Planning Act in 1965. Distribution of the giant buildings of more than 45 m in height, is shown in Fig. 7, and all these buildings were constructed after 1965.

Such upheaving of capacity ratio is, however, indistinct in the suburban city areas. This is not resulted by the stability of urbanization but by the relation of the changes in the two variables; the increase of total floor space of private building and the increase of area of housing lands. For the purpose to analyse areal characters of the change in capacity ratio, two figures are offered here; the increase ratio of total floor space of newly constructed buildings during the period from 1965 to 1975 in Fig. 8, and the increase ratio of area of housing lands in the same period in Fig. 9. Comparison of these two figures will reveal the fact that the change of capacity ratio must be grouped into the three types; (i) high increase of private newly constructed buildings and decrease of private housing land in the *ku*-area, (ii) relatively low increase values of the both components in most suburban cities where suburbanization had developed since the earlier stage along the railway line, and (iii) the higher values of the both components in the some suburban cities such as Inagi-*chi*,



(Source of Fig. 8 & 9; Land in the Tokyo Metropolis in 1976)

Fig. 8 Increase ratio of total floor space private buildings (1965 - 1975)

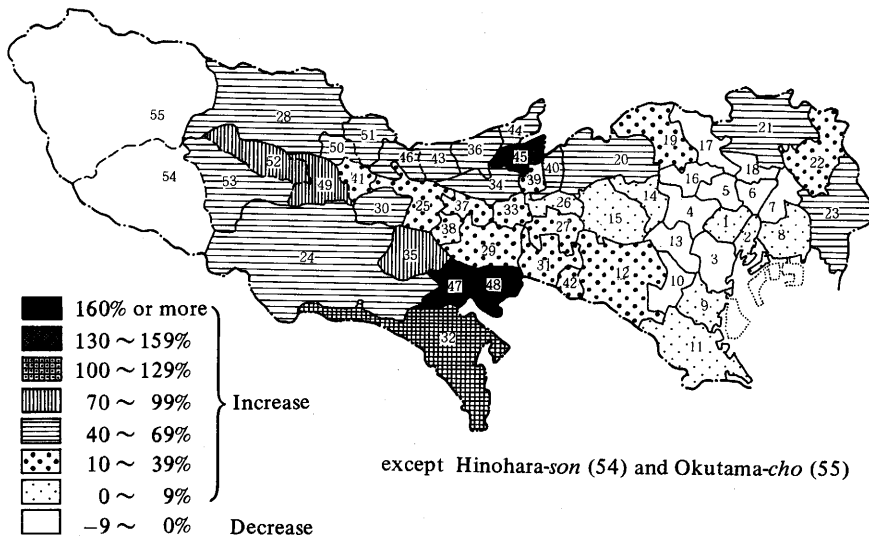


Fig. 9 Increase ratio of private housing lands (1965 - 1975)

Machida-shi and Tama-shi, in which suburbanization had not notably developed till recent years due to such reasons as their site far apart from the CBD of Tokyo, their topographical site on hill land, unfavorable conditions of railway transportation facilities and so on.

As a result, high increase ratios of capacity ratio are raised in the two types, the first type, wards area, and the second type, most suburban cities in the inside zone, as is shown in Fig. 10. In the third type, the increase of capacity ratio was not notable, because the increase ratios of private housing lands are usually higher than the increase ratios of newly

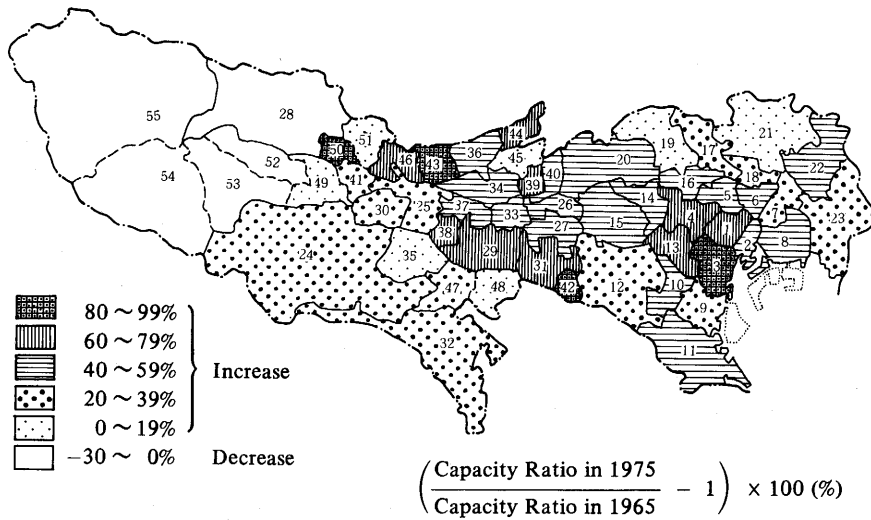


Fig. 10 Increase of capacity ratio (1965 - 1975)

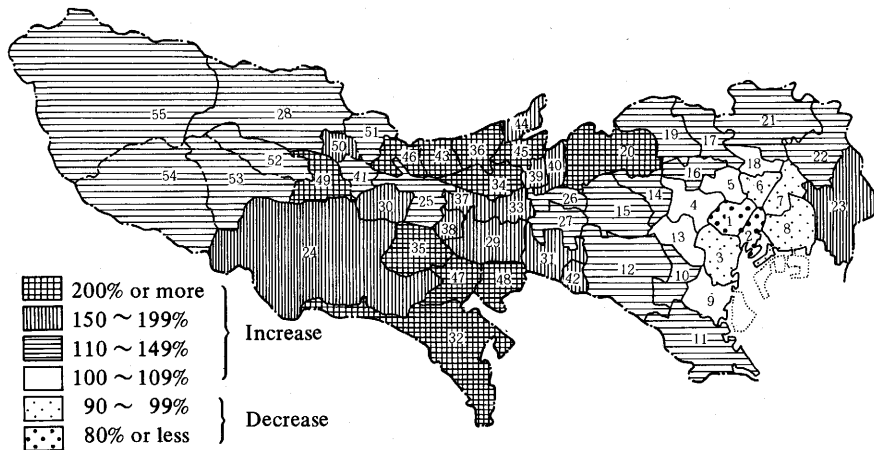


Fig. 11 Increase ratio of total floor space of wooden made houses (1965 - 1975)

constructed buildings. The reasons of the increase above mentioned are by the area somewhat different to each other, that is, being the reformation nature in the *ku*-area, the nature of open space filling up in the inner suburban cities and the suburbanization nature in the outer suburban cities. It will be well proved by the Fig. 11, in which the increase ratio of the floor space of buildings mode of traditional wood are manifested.

For the purpose of comprehending such changes of built-up area raised in the recent twenty years, a comparison of the two kinds of index values in Fig. 12 and Fig. 13 is useful. These figures show, (i) building number increase ratio in a form of rates of number of

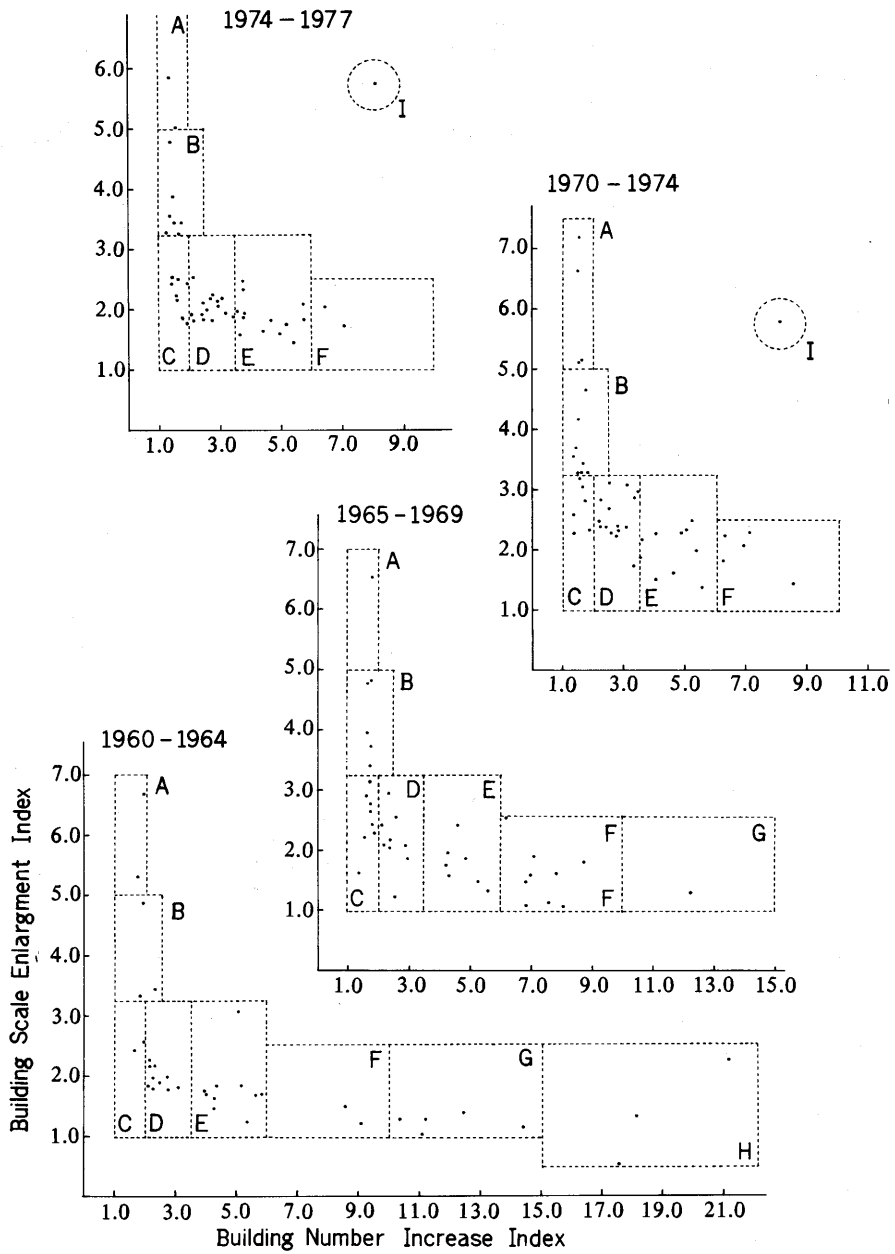


Fig. 12 Chronological change in relation between building number increase index and building scale enlargement index by area

newly constructed buildings to number of cleared buildings (BNI index) and (ii) building scale enlargement ratio in a form of total floor space in average of newly constructed buildings to total floor space in average of cleared buildings (BSE index). Original data on new building construction were obtained by the Report of Construct Submissions based on the Law of Building Regulation Act, and those on building clearance were sourced on the Report of Building Renewal Submissions based on the same act and on the Report of Building Damages by Disasters, all being published by Tokyo Metropolitan Government. All these reports compile the data on the buildings with total floor space of more than 10 m².

Here the higher BNI index may indicate a type of urbanization by the multiplication of buildings by new building construction often accompanying the procedure in which a housing lot is divided into plural ones. Similarly the higher BSE index will suggest another type of urbanization in which buildings of lower stories are reconstructed into higher stories buildings.

Values of BNI index and BSE index are in combination dotted by divisions of areas and of chronological stages in Fig. 12, and the areal types are classified into nine categories in it on the following manner.

- A = 1.0 < BNI index < 2.0, 5.0 < BSE index
- B = 1.0 < BNI index < 2.5, 3.25 < BSE index < 5.0
- C = 1.0 < BNI index < 2.0, 1.0 < BSE index < 3.25
- D = 2.0 < BNI index < 3.5, 1.0 < BSE index < 3.25
- E = 3.5 < BNI index < 6.0, 1.0 < BSE index < 2.5
- F = 6.0 < BNI index < 10.0, 1.0 < BSE index < 2.5
- G = 10.0 < BNI index < 15.0, 1.0 < BSE index < 2.5
- H = 15.0 < BNI index 1.0 < BSE index < 2.5
- I = the other

The distributing pattern of these categories is shown in Fig. 13. Five types of change of built-up area can be distinguished in observation of this figure, because the combination of the two index values indicates enough the prevailing mode of building construction in every type of built-up area in transition.

- Type I : Urban renewal : categories A and B
- Type II : Reconstruction of congested buildings : C and D
- Type III : Multiplication of housing lots and buildings : E and F
- Type IV : Simple form of urban expansion : G and H
- Type V : New town development : I

Type I is raised by the massive replacement of the new and old buildings under the regulation by the areal redevelopment planning of the built-up area. Particular high values of BSE index in this type means the results of enlargement of building scale or floor space brought by the change in this type. This type is characteristically found in the central CBD wards, local CBD wards, and the areas fronted to larger railway stations within metropolitan areas. BSE indices in the three central wards (*Chiyoda-ku*, *Chuo-ku* and *Minato-ku*) indicate so higher values as more than 500%.

Type II is brought by individual reconstruction of new, but often smaller, buildings of several-stories in congested manner on the construction yards which are produced by the

clearance of similarly congested older buildings of small size. This type is mostly found in the earlier developed built-up area, in the form of surrounding area of type I. The highest population densities in the Tokyo metropolis appeared in this area at present stage.

Type III is resulted from multiplication of buildings through the procedure of multiplicative dividing of a construction yard into plural number of small yards. It often accompanies the clearance of the ready established building in it, but sometimes older one remains in a

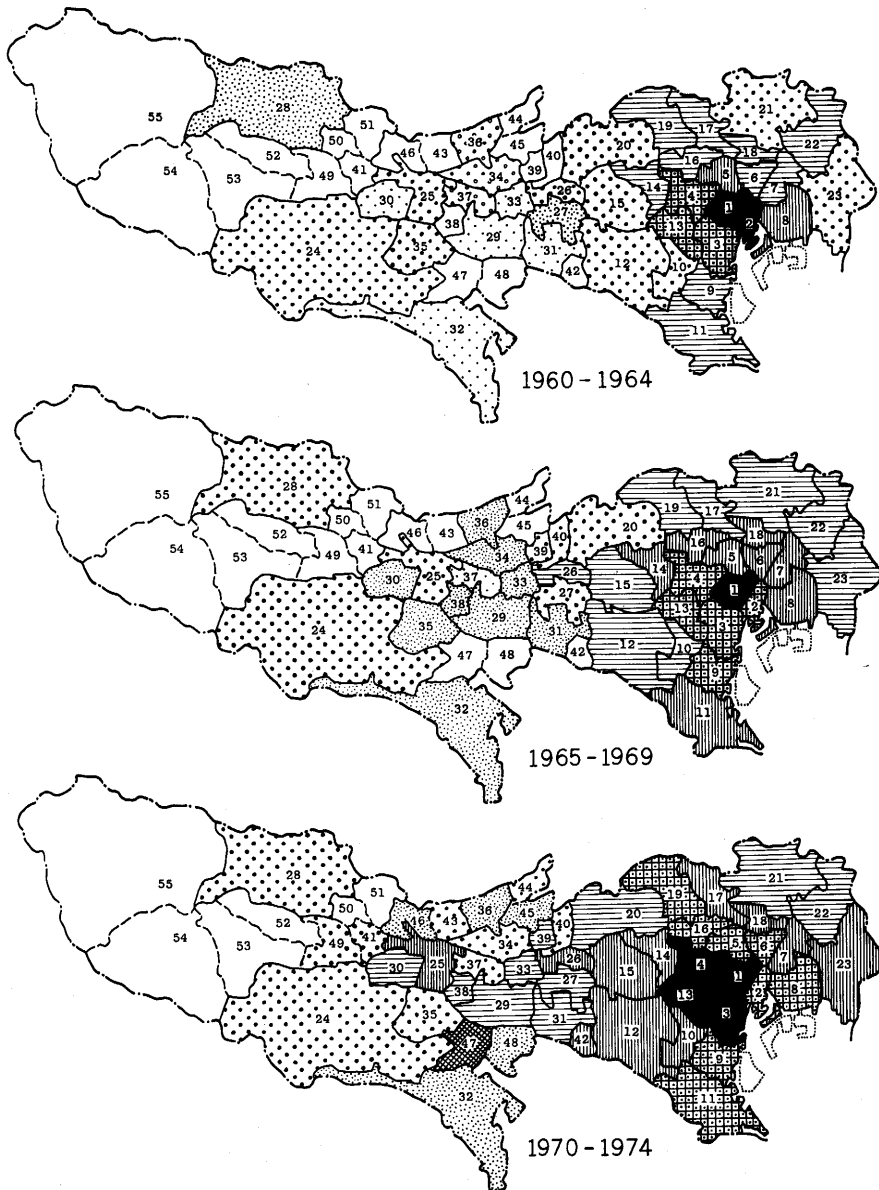


Fig. 13 (cont.)

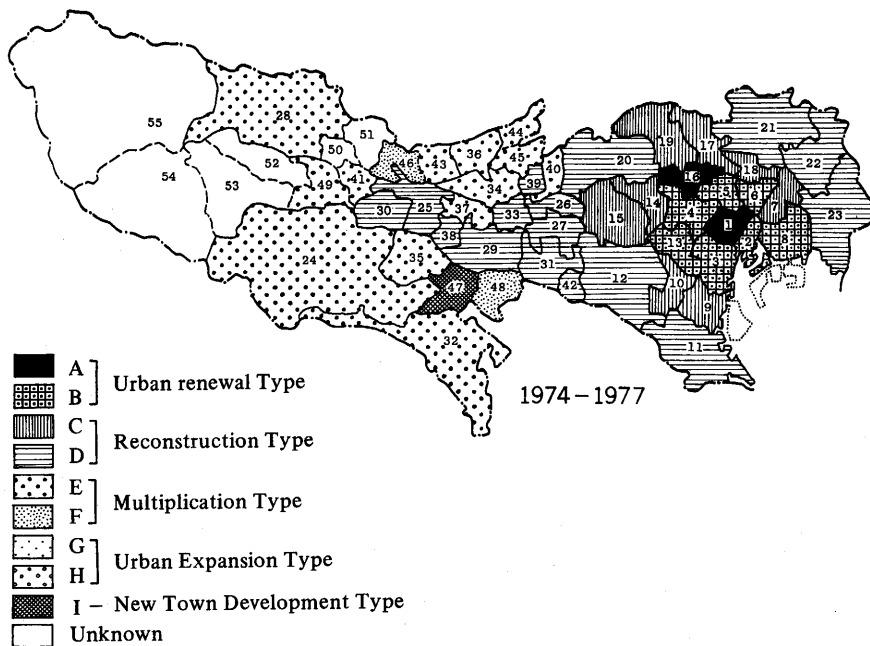


Fig. 13 Chronological change in the areal pattern of urbanization types

part of the original yard. On both the ways, an older building of independent style is replaced by a group of new-buildings on divided yards. Size of newly constructed building is frequently similar to that of older one, but open spaces within the construction yards are inevitably decreased through the process. This type is dispersedly distributed on the whole of the earlier developed built-up area.

Type IV is near akin to the usual sense of suburbanization. Numbers of buildings were newly constructed on open spaces through the legal submission of land use change from open space to housing lands. Most of the newly constructed buildings are used for dwelling exclusively, and their mode mostly presents the various styles of independent residential houses and not of apartment houses.

Type V can be distinguished from type IV not in its fundamental nature but in its high grades of increase ratio in both of the two index values. Such changes tend to occur at execution of so-called new town planning by public institutes or private companies on large scale. The most typical example will be offered by Tama-shi in the western suburbs, which contains the so-called Tama New Town developed by the co-operation of Japan Housing Corporation, Tokyo Metropolitan Government, and some private railway companies who supply the railway facilities to it. In this type, construction of a group of multi-stories apartment buildings is dominant in comparison with the ordinary style of suburbanization.

Areal constitution of these nine categories and five types is arranged in the form of the succession of the chronological stages in Fig. 12 and 13. Some features can be mentioned in it.

(1) Suburban expansion type widely appeared since the earliest days of the postwar

growth of Tokyo Metropolis and the areal change of this type constantly shifted its main field from the peripheral zone in the *ku*-area towards the outer zone far apart from the CBD throughout the period. But this type is not apparent after 1970 in the western suburbs of Tokyo, in which the multiplication type has begun to appear instead of this type.

(2) New Town type was derived from suburbanization only in the outer peripheral sites of suburbanization zone on the later stage.

(3) Multiplication type became apparent rather in the outer residential on relatively later days. Small scale changes of this type had precedently realized at the reconstruction changes in the inner *ku*-area, but they were hid in statistics behind the vigorous changes by the below two types. The change of this type, being combined to the change of reconstruction type, brought especially into the high class residential quarters the compacting of residential house units and the diversification of residential house styles.

(4) Reconstruction type was created at first in the north-eastern wards surrounding the CBD, so-called *shitamachi* (downtown) districts, and next spread on such western wards of the *ku*-area as Shinjuku-*ku*, Shibuya-*ku*, and Toshima-*ku*, where sub-CBD were rapidly growing in accordance with the westerly biased development of the Tokyo Metropolitan area in that time. Changes of this type tend to prevail over the whole *ku*-area, at present stage, but their nature has been somewhat transformed from exclusive reconstruction of office and industrial buildings in the former CBD wards to that included residential buildings in the present residential wards such as Meguro-*ku*, Setagaya-*ku*, and Suginami-*ku*.

(5) Urban renewal type arised at first in the CBD wards, but Chuo-*ku* at eastern corner of it has been decreasing its BSE index since earlier days. After then this type has dominated gradually not only over the CBD wards but in the more widely inner *ku*-area, but it has hardly prevailed in outer residential wards till today, because of its peculiar system of complicated cost allotment and limits by land use zoning.

(6) These all changes are, however, decreased its intensity in recent years after the decline of the growth of the national economy in about 1974. Yet the change of reconstruction type has just begun to start in some areas in the suburbs where the suburbanization developed on the earliest days and the present features in their residential districts are so matured that it become similar to that of the outer *ku*-area in 1960's.

The various aspects above described will clarify enough the fact that postwar growth of Tokyo is constituted with the two components of urbanization, the out skirts expansion of built-up area and the redevelopment of established built-up area. Furthermore, observation of the chronological change in the areal pattern of urbanization types, as shown in Fig. 13, may reveal the fact that areal types of the changes on each chronological stage are produced in the combination of the above two components of urbanization.

Explanation of these areal aspects is, however, not simple because the relation of the two components is somewhat complicated. Fig. 13 may also show the fact that slight but noteworthy inconformity should be noticed on the chronological progressions of the two components of urbanization.

Succeeding the gradual expansion in the period of recovering from the war destruction, animated outer expansion had started in about 1955, just after the turn of Japanese economy toward the rapid development. The maximum index values had already appeared in earlier developed areas in the expanding suburbs at that stage during 1960 - 64, and both

of the index values turned to reduce after 1965. On the other hand, redevelopment of built-up area or vertical expansion of buildings could not be realized vigorously under the regulation by older law of City Planning Act till about 1965. Necessity of increasing floor space of this city was more distinctly responded by the lateral expansion towards suburbs in this period. Apparent vertical expansion of built-up area started after then by the amendment of the Laws of the City Planning especially in 1965 and 1968. As the succeeding of rapid outer expansion of built-up area became more difficult by various reasons after the later 1960's, redevelopment works of the ready established built-up area became to perform more important role on obtaining new floor space in increasing demand. Though it rapidly spread over into the whole built-up area ready established, yet the maximum index values arised in the such delayed period as in 1970–74 even in most of the CBD or sub-CBD wards; that is, Chiyoda-ku, Minato-ku, Shinjuku-ku and Shibuya-ku.

The five areal types concerning to the changing character of built-up area above stated were formed at each stage on this course in combination of the two compornents of urbanization which have respectively progressed with chronological inconformity to each other. At present stage, changes of the reconstruction type began to overlay the past suburban type along the Chuo line developed on the earlier days before 1955, due to the reason that durable years of wooden made houses are generally about thirty years at largest.

It is clear that the areal variations in the change of built-up area presented in Fig. 13 should be interpreted as the resultants of the own history of the growth of Tokyo Metropolis. But these aspects in the figure may offer us an idea that a rule of progression of metropolitan built-up area in time sequence might be derived from them by combining them

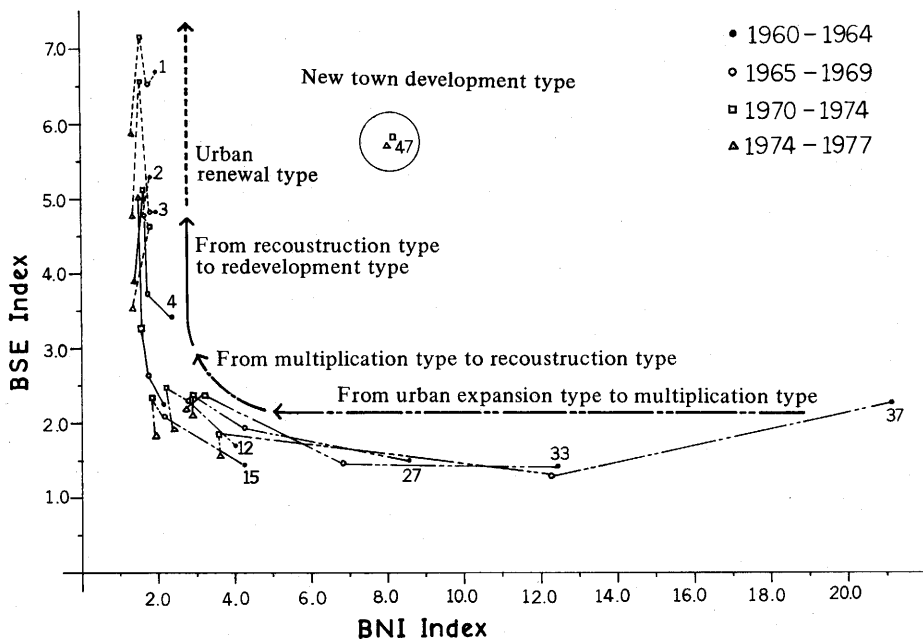


Fig. 14 A hypothesized process of urbanization of metropolitan built-up area

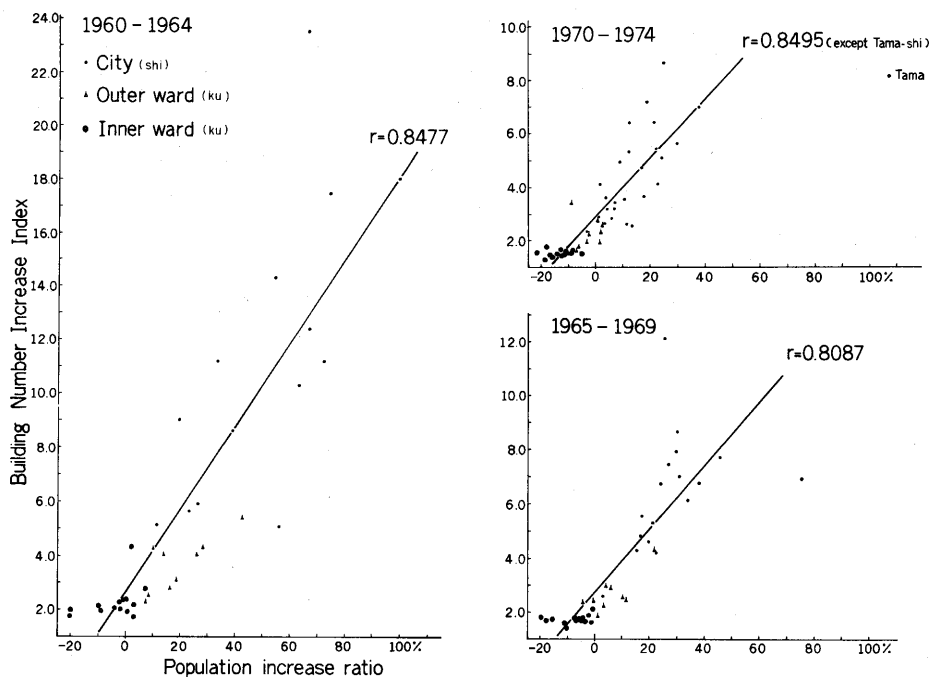


Fig. 15 Correlation between building number increase index and population increase ratio

in deliberation on a single phase of time stage. A device to verify the idea is adopted in Fig. 14, in which the changes of some sampled built-up areas collectively represented on the measures of the two kinds of index values. The sampled areas are listed up as follows, in which the annotated number indicates the index number in Fig. 1 and Fig. 14; (1) Chiyoda-ku, (2) Chuo-ku; the above two belong to early urban renewal type. (3) Minato-ku, (4) Shinjuku-ku, (6) Toshima-ku; the above three belong to recent urban renewal type. (12) Setagaya-ku, (15) Suginami-ku; the above two belong to reconstruction type. (27) Mitaka-shi; this originally belonged to multiplication type and shifted to reconstruction type recently. (33) Koganei-shi, (37) Kokubunji-shi; the above two originally belonged to urban expansion type and have shifted to multiplication type recently. (47) Tama-shi; this belongs to new town development type.

There observed a hypothesized process of urbanization of built-up area; from development to redevelopment. Presumable base of the hypothesis will be laid on the consequential succession of the changing modes of built-up area. The threshold on the left lower corner in the figure may suggest the discontinuity of the two wings of sequential change, that is, the departure of vertical expansion, or redevelopment stage, of built-up area from lateral expansion, or suburbanization stage, of built-up area. The former changes include those in CBD and other type of more small scales in business and industrial districts.

With regard to the postwar growth of Tokyo on microscopic view, clear correlation can be observed between BNI index and population increase ratio as is shown in Fig. 15. This means that enlargement of the metropolis has been sustained till today primarily on the

metropolitanization of Tokyo, remarkable increase of residential houses of apartment style is one of the most unique characters of the postwar metropolitanization. This manner of modification of residential area had become apparent in the recovering period from the war damage. It started, at first, in a style of poor two-stories houses made of wooden, and this style once dominated over newly furnished dwellings in the *ku*-area in the early half of the

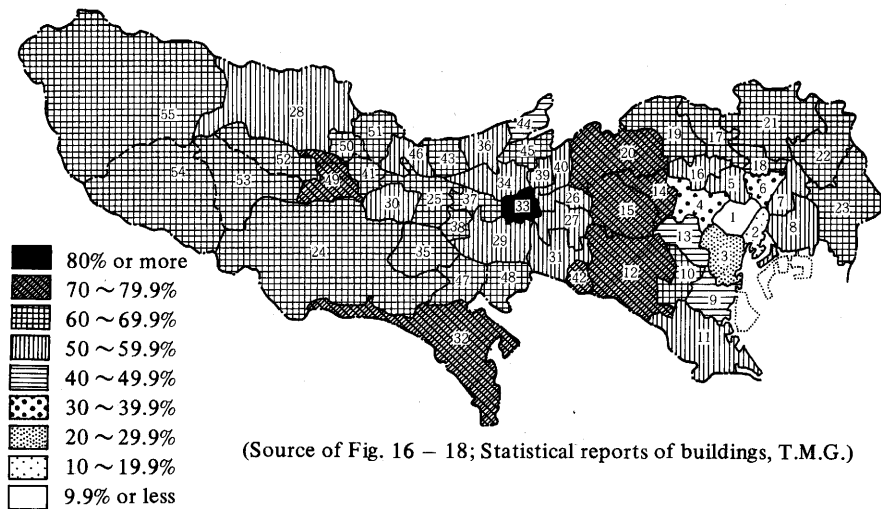


Fig. 16 Composing rate of dwelling houses to all new construction (1970 - 1974)

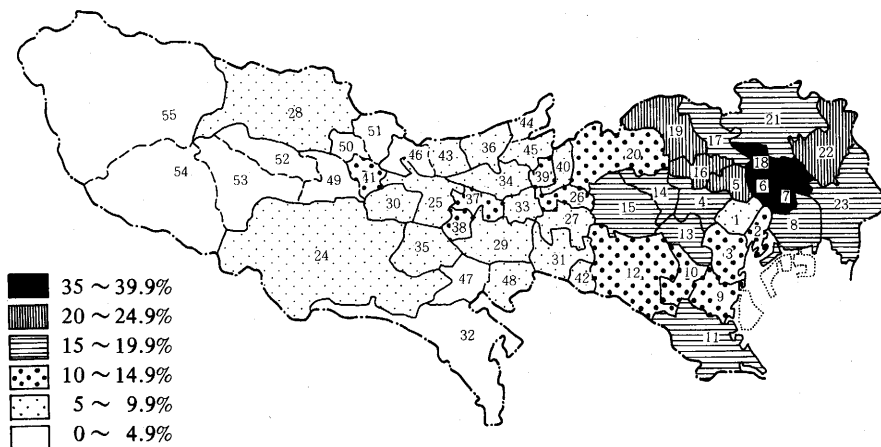


Fig. 17 Composing rate of buildings for combination of dwelling and other usage to all new construction (1970 - 1974)

increase of buildings in the meaning of BNI index. This suggests the past metropolitanization has been constituted on the shifting on the lower horizontal wing in Fig. 14. But observation of Fig. 15 reveals the fact that population increase in this form has been gradually shrinking its grades year by year. Perhaps this means the fact that redevelopment of built-up area, or the shifting on the left vertical wing in Fig. 14, has recently become enlarging its role in the metropolitanization of Tokyo.

V. CONSTRUCTION OF DWELLING HOUSES AND DIVERSIFICATION OF TYPES OF DWELLING HOUSES

Fig. 16 shows the fact that total floor space of newly constructed residential houses (dwellings) occupies the largest share in the whole types of new buildings in most of the areas throughout the period. Its higher values are, as is expected, found in the zone from the outer *ku*-area to the inner suburban area. Among them, the maximum values are shaped in the most recent period during 1970 – 74; for example, 80.9% in Koganei-*shi*, 74.8% in Suginami-*ku*, and more than 70% in the five administrative units of Nerima-*ku*, Nakano-*ku*, Setagaya-*ku*, Machida-*shi* and Komae-*shi*. It is worthy of note that these values exceed the highest values in the past periods, for example, 69.8% in Mitaka-*shi* and 68.5% in Koganei-*shi*, both in the period 1960 – 64. On the contrary, the values of population increase ratio are generally higher in the period 1960 – 1964 than in the period 1970 – 74, though the increase ratio of households during 1970 – 74 are far exceeded by those in the preceding two periods. These features may imply the fact that the enlargement of the share of residential houses trends to appear, accompanying the increase of households, in the delayed time to the increase of population. Probably, the reasons for such tendency will contain the followings; (i) social change of family system in metropolitan life from the large-member family system to the smaller one, (ii) age growing of younger emigrants to form families, and (iii) enlargement of floor space per family resulted from enlargement of size of residential houses which is again brought by upheaving of living standard (or income) level. Through these courses, the metropolitan area of Tokyo seems to be now, in macroscopic view, inclining to the nature of residential land in the meaning of architectural equipment. The revival specialization into exclusive residential districts in the outer *ku*-area is one of its typical case, as is shown in Fig. 16. While the residential houses in the above meaning are increasing in recent years, this city has held great amount of dwelling houses of peculiar type in which usage for dwelling is combined to the usage for such jobs as shop, domestic industries and others. This type of houses, which was inherited from feudal *Edo* town and maintained by the peculiar nature of Japanese industries, are still newly constructed at present stage. The proportion of this house type in newly constructed buildings in the period 1970 – 74, is illustrated in Fig. 17. Its high proportions can be observed in the *ku*-area, especially such down-town area as Taito-*ku*, Arakawa-*ku* and Sumida-*ku*, where the domestic industries were traditionally developed in congregating manner. The highest proportion of small scale land owners of less than 100 m² is one of the reasons of survival of this traditional house type in this area.

While the traditional house type above stated has still maintained even in the present

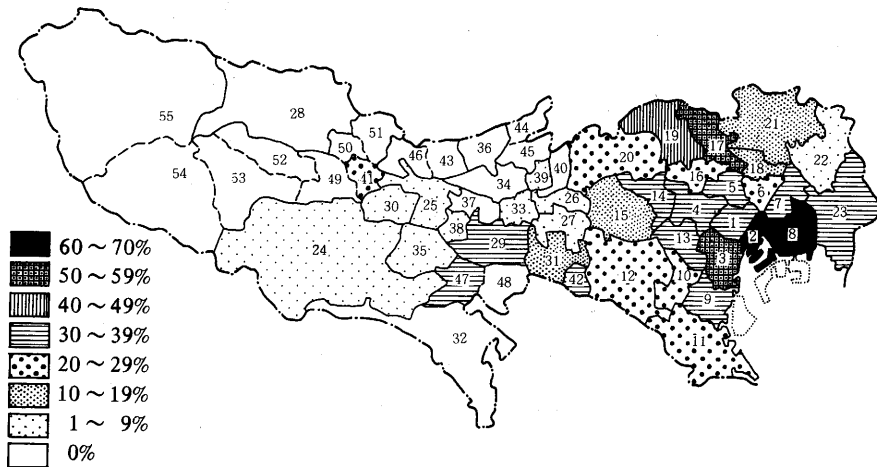
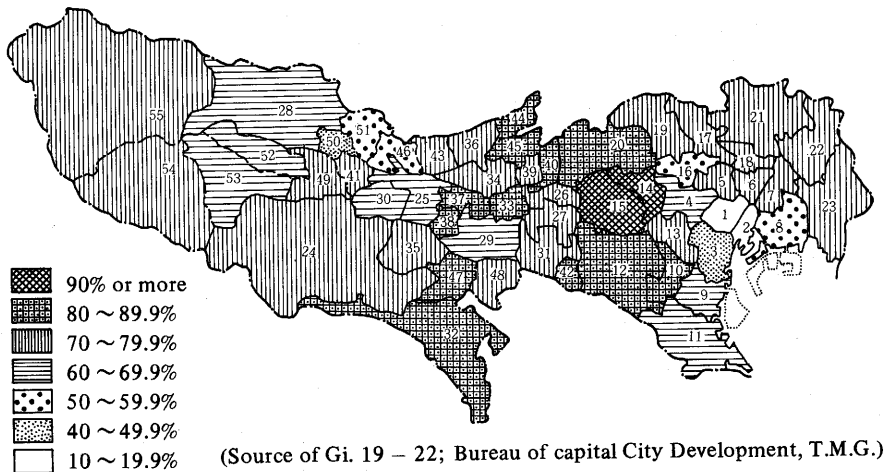


Fig. 18 Composing rate of apartment houses more than 6 stories to all newly constructed dwelling houses (1971 - 1973)



(Source of Gi. 19 - 22; Bureau of capital City Development, T.M.G.)

Fig. 19 Composing rate of all kinds of dwelling houses to all existing buildings in 1975

rapid growth of Tokyo after 1955. But on subsequent stage, more refreshed style of apartment houses, high building style of mostly over six stories, appeared in the ku-area. This style of apartment houses, which partly inherited its characters from the public housing works in distant suburban area, have great advantage of effective land use in the condition of insufficient land resources within the ku-area. Therefore this style is preferably adopted at redevelopment of built-up area, and gradually began to dominate to the older style

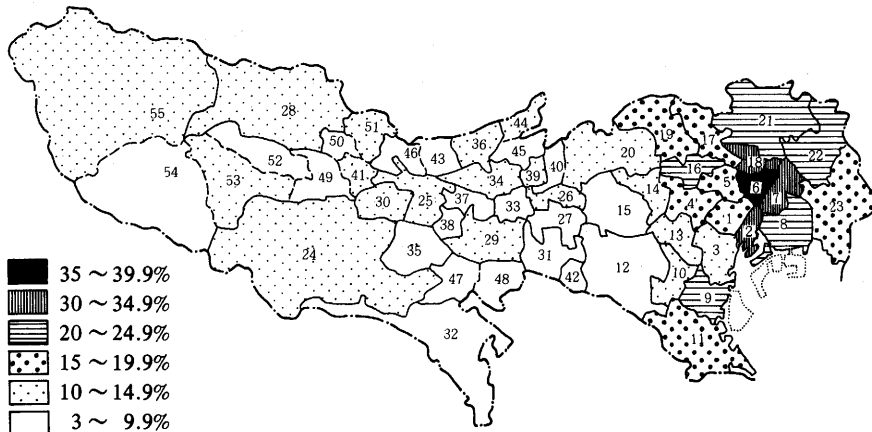


Fig. 20 Composing rate of existing wooden made buildings for combination of dwelling and other usage to all dwellings in 1975

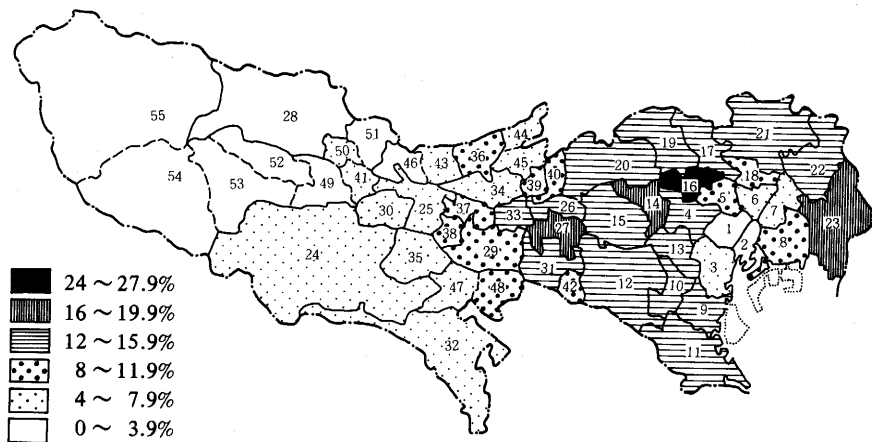


Fig. 21 Composing rate of existing wooden made apartment houses in to all dwellings in 1975

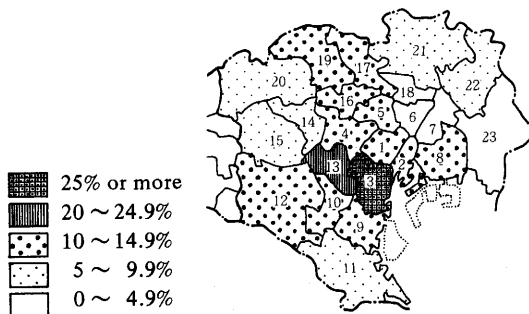


Fig. 22 Composing rate of existing non-wooden made apartment houses to all dwellings in 1975

of apartment house of low stories in the later half of the metropolitan development. Figures from Fig. 18 to Fig. 22 are prepared for the observation of the aspects above stated.

VI. CONSTRUCTION OF NON-RESIDENTIAL BUILDINGS

It can be understood through the preceding description on the aspects of residential buildings that non-residential buildings are not greater participants in increase of buildings in the metropolis and that its share, too, has been decreasing recent years. But some aspects on the construction of these kinds of buildings will be supplementally described in this chapter in brief.

Buildings for commerce and services such as rental office, hotels, banks and so on, are still restrictedly concentrated at present stage into the inner *ku*-area which consists of Chiyoda-*ku*, Chuo-*ku*, Minato-*ku*, Shinjuku-*ku*, and their neighbor wards. Areal characters found in the new construction of these types of buildings are, however, somewhat different to such pattern of distribution of existing buildings of these types. Increase of these buildings in some nodal cities in suburbs seems to be more distinctly observed than those in the outer *ku*-area or expansion area of CBD. Such the tendency can probably be explained on the two courses; either the results of the maturing of the suburban expansion, in which enlarging population and economical potency require their own central functions, or the affection of the residents' resistance against invasion of those functions in the outer *ku*-area where the specialization toward exclusive residential area has been maintained or enlarged in revival form. The aspects of construction of residential buildings described in the above chapter show it. Both of the courses will bring the single result; that is, segregative decentralization of buildings for commerce and service into suburbs.

The areas where vigorous new construction of the buildings for manufacturing industries still succeeded during 1970 – 74 are, in its essential pattern, similar to the case of buildings for commerce and services, being separated into the two zone of inner *ku*-area and the suburban area. Only, these two areas are distributed in respectively a little outside of the areas in which new construction of buildings for commerce and services distributes; for example, Ohta-*ku*, Sumida-*ku* and Kohto-*ku* in the southern or eastern wards of the CBD wards or Musashimurayama-*shi* and Akishima-*shi* in the outer suburban area. In comparison between the distribution of composing ratios of newly constructed buildings for industries during 1970 – 74 and those of existing buildings in 1975, these two kinds of distributions indicate probably same pattern, being different to the case of buildings for commerce and services. This is probably raised by the fact that manufacturing functions had already been decentralized into the suburban zone prior to the decentralization of buildings for commerce and services. But their increase still remains in the inner *ku*-area of the more older core of industries in Tokyo, which includes down-town light industries area originated in feudal *Edo* town. In this inner area, the renewals of manufacturing factories are vigorously executed at present stage and they functionate to increase the number of new construction of manufacturing buildings in statistics. The figures from Fig. 23 to Fig. 26 will be proved enough the above description.

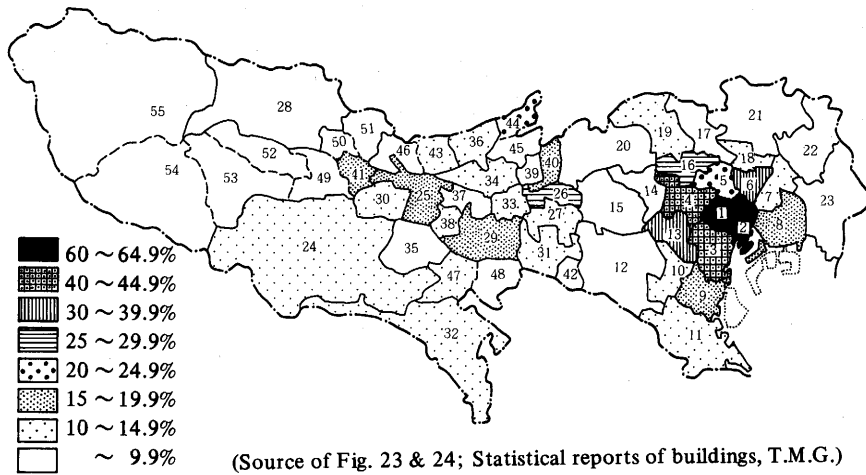


Fig. 23 Composing rate of buildings for commerce and service to all new construction (1970 - 1974)

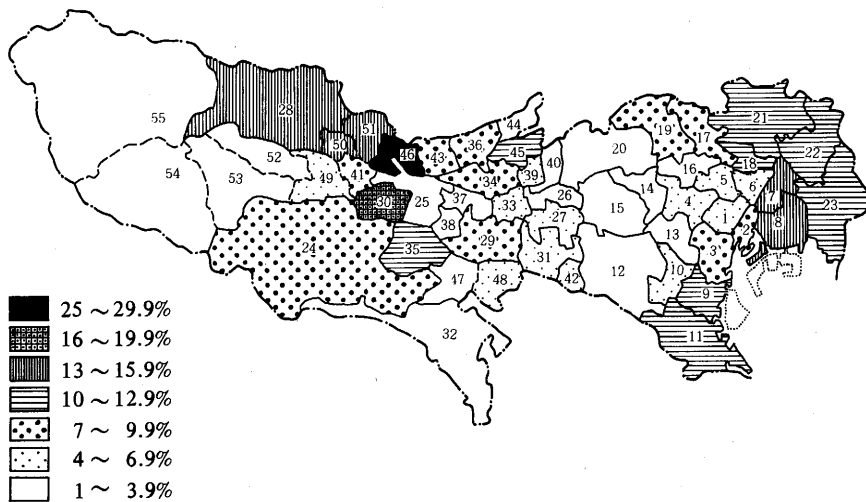


Fig. 24 Composing rate of buildings for industries to all new construction (1970-1974)

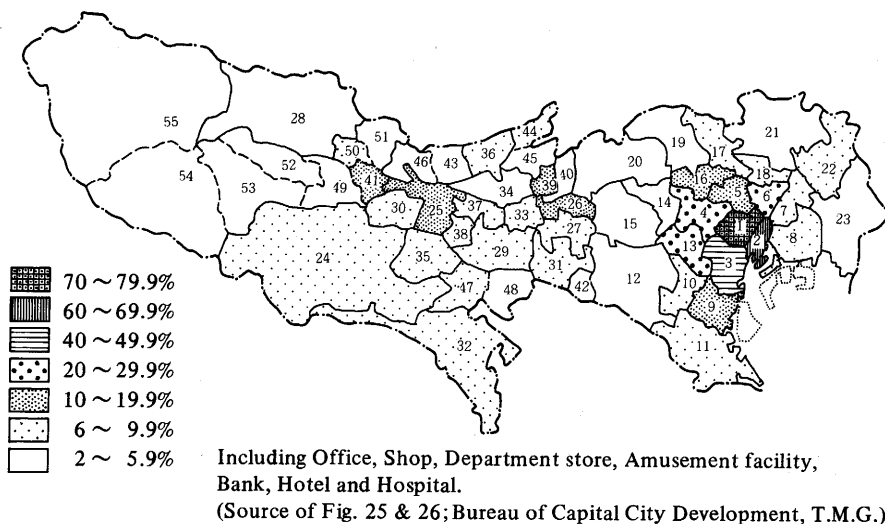


Fig. 25 Composing rate of buildings for commerce and service to all existing buildings in 1975

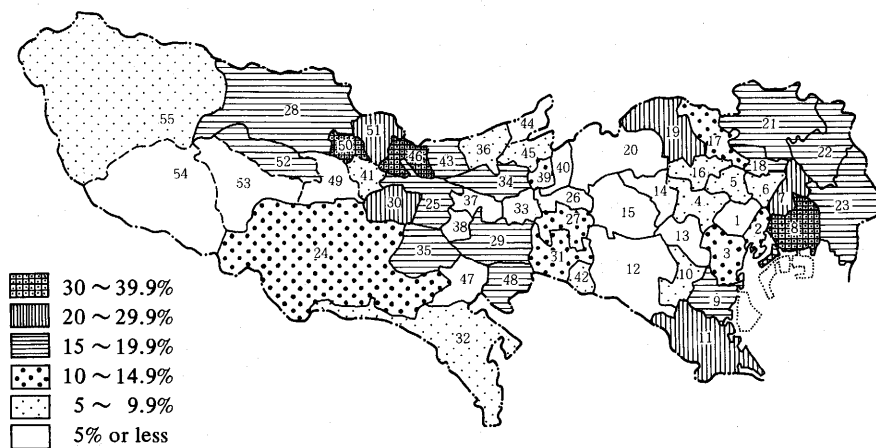


Fig. 26 Composing rate of buildings for industries to all existing buildings in 1975

VII. A SUMMARY ON THE RECENT CHANGES OF BUILT-UP AREAS AND THE ENVIRONMENTAL PROBLEM ARISING IN THEM

Here will be summarized some of the features mentioned in this paper. Regional division of Tokyo (*to*-area) into the eight areas is used for the purpose.

1) Inner *ku*-area

The whole wards are more or less colored with CBD character, which originally created in the two central wards of Chiyoda-*ku* and Chuo-*ku* and laterly expanded to their

neighbouring wards, especially to *Minato-ku* and, in addition, the sub-CBD wards such as *Shinjuku-ku* and *Shibuya-ku*. The capacity ratio in it manifests the predominantly high values among the areas, though the areal density of the inhabitants is lowest in the *ku*-area and the inner suburban zone. Increase of constructed buildings or their floor space is distinctly high in this area, due to the great amount of new construction of buildings for offices and shops. Such increase of floor space in this area is, in its majority, furnished to by the rebuilding process, in which the new higher-stories buildings has substituted for the old lower ones. Therefore, the upheaving of capacity ratio, too, is represented quite typically through this renewal tendency covering the whole area.

2) Northern, eastern and southern outer *ku*-area

Both proportions of buildings for industries and of buildings of combined use for dwelling and jobs are originally high among the areas. The ratio of buildings for industries in the whole newly constructed buildings is also high, reflecting the above features.

This area may be grouped into the two sub-areas. (i) The one is the earlier built-up area after the Great Kanto Earthquake. The scales of buildings are generally extremely small, and the congestion of such mini-size buildings forms the typical down town character where the population density is quite high and various land use units of small size are intermingled with each other in traditional manners. This area is also on a stage of renewal. But distinct increase of capacity ratio can not be found in this area, because new rebuilt buildings are also relatively small due to the poor investment. (ii) The northern and eastern parts of this area are recently built up with character of combination of residence and industries, and still hold to some extent small open spaces because of their site where the traffic facilities had been till recent years unfavored. Therefore, these open spaces are animatedly filled up at present stage with diversified buildings of collective low-stories private houses, collective high-stories apartment houses, buildings for industries and so on. Some of the new factories are decentralized from the above sub-area and the following area, requiring the larger new yards of low land price.

3) The area around the inner *ku*-area

The small transitional area can be identified, being inserted between the above two types of area. This area originally represents the typical down town features quite similar to the second type area, and a part of central business functions in the first type area has recently gradually penetrated into this area without any notable renewal process. Building style as well as capacity ratio in this area is consequently immovable, and its highest density of inhabitants among the areas is exhibited because of extreme congestion of mini-size buildings and of lack of renewal stage.

4) The western outer *ku*-area

This area was properly built up with character of exclusive residential use, and this character has been still maintained at this stage or seems to be somewhat promoted in recent years as the composition of newly constructed buildings for dwelling suggests it. But its dominant prewar character of high-class residential area has to a great extent altered to the commixture of various styles of residential buildings. The urbanization stage in this area contained all of the areal urbanization type; that is, the rebuilding type and the multiplication type above stated, including the rebuilding and multiplication of the abundant apartment houses of wooden made low stories type in the earlier postwar period. Through

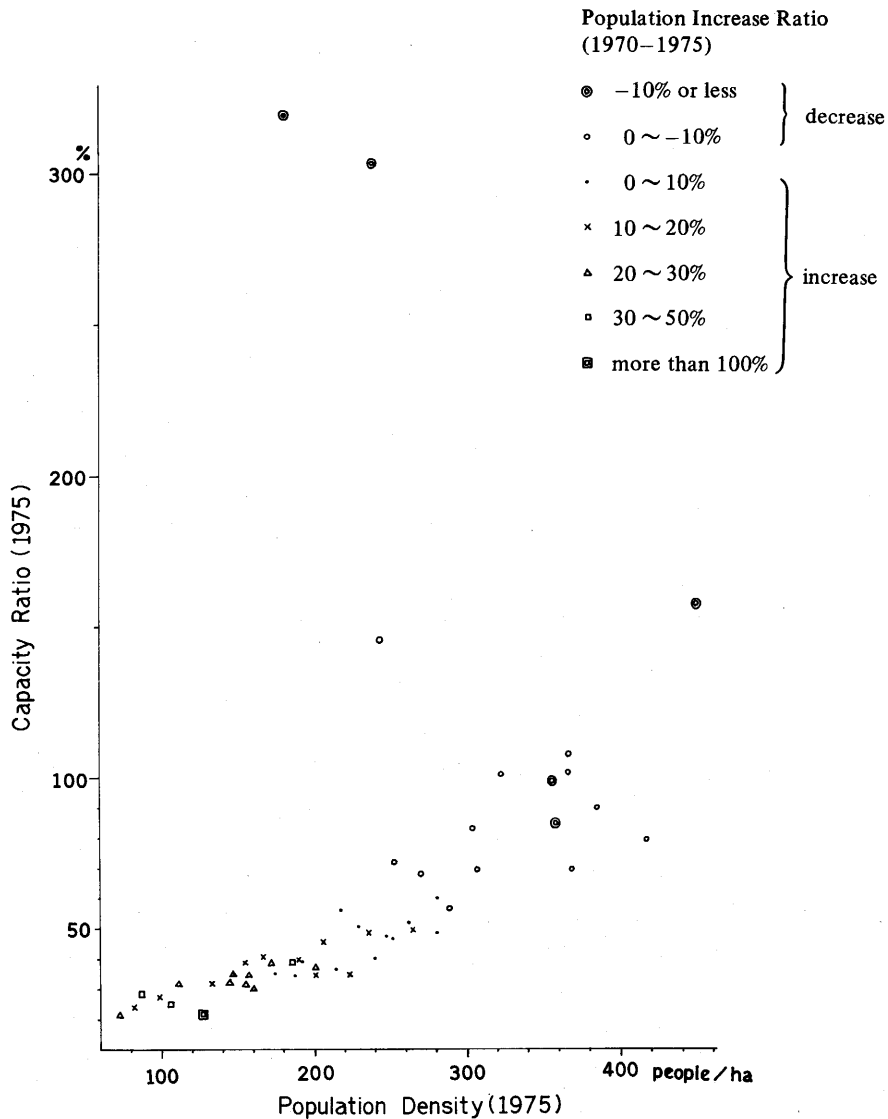


Fig. 27 Interrelation among capacity ratio and population change

such urbanization stage, relatively wide housing land units on the prewar days have been divided into mini-size ones, and both of the population density and capacity ratio has been considerably elevated in recent years, though the building of high stories apartment of more than four stories is in most of the areas restricted by the law of City Planning Act.

5) Inner suburban area

In both of the characters of built-up area and of the chronology of development, this area is undoubtedly ranked to the immediate successor of the outer *ku*-area. However, its actual distribution does not shape a band circumscribing the *ku*-area but presents ribbon for-

mation along the railway, such as Tachikawa-shi, Musashino-shi and Fuchu-shi. Its proper development style in the wartime and early postwar period is commixturing of pioneer establishment of manufacturing factories, private residential houses, commercial buildings, and others. Such commixture style was one of the peculiar characters of rapid suburbanization in the earlier suburban development, and it produced suburban cities of satellitic style. During the postwar suburbanization period, collective residential housings by public corporation and individual private residential houses including wooden made apartment houses dominantly filled up the area, until its general features has become somewhat similar to the western outer *ku*-area. Population densities and capacity ratios are quite diversified by the area because of the process of their formation. At recent stage, areal renewals of older built-up area have already started especially in the areas fronting on the railway stations, and new buildings for commerce and services are mentionably increasing in accordance with the development of surrounding areas.

6) Outer suburban area

The areas surroundig the inner suburban area can be grouped into the two sub-areas.

(i) The one is the area of exclusively residence, which mostly contains more or less large scale development of collective new housing lands. Tama-shi in which famous Tama New Town Project has been developed, represents most typically the character of this sub-area. Combination of collective high stories apartments and low stories private house is the standard formation in this area, whereby the modelate increase of capacity ratios is resulted.

(ii) On the other hand, some manufacturing industries has still continued their development in the rest area of outer suburbs. As it is shown in the high ratio of the new construction of the buildings for industries. Consequently, co-existing of newly developed industrial building and residential houses appears. But both the two are respectively developed on the relatively large scale and separated from each other in their areal occupation. Therefore, intermixture pattern of the two does not be produced, differently to the case of the eastern outer *ku*-area.

It is observed that the height of buildings has been continuously enlarging in recent years through the rebuilding process of built-up area, at least in the former five areal types where the renewal works prevail, and that spaces between the adjacent buildings have been diminishing there because of the multiplication of mini-size building lots. These changes of built-up area raised one of the important environmental problems on the metropolitan life, that is, the problem of lost sunshine in the residential areas. The failure of sun lighting is fatally severe problem for residents in the climatic conditions, humid summer and cold winter, in this nation and in its traditional living mode. Numerous troubles happened between residents who want to prevent themselves from failing sun shine and builders who want to promote renewal of buildings of built-up area.

One of the purposes of the partial revise of the law of the Building Regulation Act in 1976 is to endow the security of sun shine condition for residents. The height limit uniformly applied for newly constructed buildings were recalled and it was respectively determined for various land use zones on the calculation of shadow hours. Applied area of this regulation is designated such five land use zones as the two grades of the exclusively residential zone, standard residential zone, zone of commerce of neighborhood type and low intensity industrial zone.

These troubles concentrates in the *ku*-area except the CBD wards where many inhabitants

had retreated from it. It is already stated that most part of the *ku*-area marks the capacity ratio of over 40% in 1975. These high capacity ratios consequently accompany the corresponding high population densities, and in most of these wards, population has turned to decrease. A part of its reason can be easily supposed; the congestion of buildings and spoiling of sun shine condition. For the purpose to examine the relation of capacity ratio and population change, the situation of every area in Tokyo (*to*-area) is plotted in Fig. 27. It can be observed in it that population begin to decrease when capacity ratio marks 60% (or corresponding population density of about 300 people per hectare). This may suggest that 60% in capacity ratio means a critical value to maintain satisfactory environmental conditions for residents in this metropolis. As it is clarified in this paper, however, recent architectonic changes of built-up area undoubtedly operate on the capacity ratio everywhere to step in the steady access to this critical value.

ACKNOWLEDGMENT

The author wishes to express his gratitude to Professor Dr. Y. Watanabe, Department of Geography, Tokyo Metropolitan University for his kindful guidance and advice.

REFERENCES CITED

- Hoyanagi, M. (1933): The iso-density map of houses in western part of greater Tokyo*. *Geogr. Rev. Japan.* 9, 57-76.
- Murata, T. & Kiuchi, S. ed. (1957): *Geography of Tokyo and Its Planning*** . Regional Conference in Japan, International Geographical Union.
- Nakabayashi, I. (1975): Recent transformation of residential quarters in Japanese metropolitan city** . *Geogr. Repts. Tokyo Metrop. Univ.*, 10, 83-100.
- (1978): Recent transformation of the residential districts and living environment in metropolitan area in Tokyo*. *Comprehensive Urban Studies*, 4, 37-61.
- Tokyo Metropolitan Government (1976): Land in the Tokyo Metropolis in 1974**. *TMG Municipal Library.* 12.
- (1976): Land in the Tokyo Metropolis in 1976*.
- (1978): City Planning of Tokyo**. *TMG Municipal Library.* 13.
- (1961-1979): *Statistical Report of Buildings in 1960-1978**.
- Watanabe, Y. (1972): Some aspects of recent Japanese metropolitan growth**. *Geogr. Repts. Tokyo Metrop. Univ.* 6/7, 51-62.
- (1978): Intra-urban migration of residents within the metropolitan region*. *Comprehensive Urban Studies.* 4, 11-35.
- Watanabe, Y. et al. (1980): Urban growth and landscape change in the Tokyo metropolitan area**. *Geogr. Repts., Tokyo Metrop. Univ.*, 14/15, 1-26.
- Yamaga, S. (1960): Urbanization in the suburban area of large cities - case of the western suburb of Tokyo -*. *Jour. Geogr. (Tokyo).* 69, 1-13.

* In Japanese

** in English