

ALTERNATIVE HOUSING DESIGNS
FOR CHANGING LIFE-STYLES IN JAPAN

by

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B.A., University of California, Berkeley, 1979

Submitted in Partial Fulfillment of the Requirements of the
Degree of

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at the
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Alternative Housing Designs for Changing Life-Styles in Japan

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ABSTRACT

The purpose of this thesis is to determine the factors affecting the transformation of user requirements for a single family detached house by analyzing changing technology and life-styles of the traditional and modern house and to use these factors as guidelines for alternative building systems.

Chapter 1 gives an overview of trends in housing construction and describes the user requirement profile with required floor area for each life stage. In Chapter 2, the underlying ideas of house, family and home in Japanese culture are analyzed to determine the factors which influence housing design and the way the Japanese live. Specific changes in life-style and housing design were analyzed in order to clarify certain issues which affect residential design. In Chapter 3, alternative performance statements are determined, based on changing life-styles. Chapter 4 briefly describes the four-stage development of housing industry technology after WWII. In Chapter 5, typical house plans of three selected development stages are compared and analyzed with regard to changes in technology. Principal transformation factors are derived from this analysis. Finally, projected trends assessing the future of building systems in Japan are discussed in the conclusion.

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INTRODUCTION

In the time since WWII, housing in Japan has change drastically under the stress of foreign influence, technological development, and changing life-styles. Various new types of housing have been developed by both the public and private sectors to meet the demand of the people. These changes have been influenced by the use of new materials, different building systems, developing housing technologies and, in particular, changing life-styles.

The objective of this study is to examine and analyze how technological developments and changing life-styles affected housing design in Japan. A middle income single family house is analyzed for three different time periods: "Traditional," built between 1868 and 1945; "Intermediate," built between 1945 and the 1970's; and "Modern," built since the end of 1970.

Conceptual analysis of the Japanese house, family, and home is given. The issues of "privacy" and "changing woman's role" which underlie Japanese culture are discussed to give clues to understanding both traditional and modern Japanese housing design. The analysis involves physical changes and technological development as well as social factors. In comparing houses of the three periods, it can be seen that some design elements change more than others, and some remain unaltered. The impetus for physical transformation may be technological or social, and physical change may in turn influence further adptations in housing or life-style.

This study attempts to draw attention to the importance of the underlying causes which affect changes in housing design; changes which people tend to ignore or misunderstand and attribute to

fashion or taste.

As yet, there is no single book which discusses these issues. I used reliable sources and extracted the essence from the information and put together the pieces according to the issues raised in this study. I hope this thesis will help those people who are interested in Japanese residential architecture, by giving them the background behind the physical forms rather than merely conveying some vague impression of the mystique of oriental culture.

1 BACKGROUND

- 1.1 A Brief Overview of Housing Today
 - 1.11 Trend of Housing Construction
 - 1.12 Summary
- 1.2 User Requirement Profile

1.11 Trends in Housing Construction

Both public and private agencies have been building housing in Japan. The public organizations are Japan Housing Corporation (J.H.C.) and smaller local government agencies. In the private sector we have: condominium developers, speculative house developers (single-family housing with site), prefabrication companies, general contractors, and independent carpenters.¹ Generally, there are four kinds of housing found

on the market: condominiums (Manshon), speculative houses (Tateuri jutaku), prefabricated houses, and conventional houses, as shown in Table 1.

The post WWII period gave birth to a proliferation of high-density residential developments in Japan, Europe, the United States, South America, and elsewhere, aimed at the pressing problem of a world-wide housing shortage.

Table 1. Housing Types in Private Ownership Related to Acquisition and Construction Types

| Type | Housing type | | Acquisition | | Construction type | |
|---------------------|---------------|---------------------|-------------|------------------|-------------------|--------------|
| | Occupancy | height | House | House with site | Prefab. | Conventional |
| Condominium | Multi-family | More than 4 stories | Yes | Occasionally Yes | Yes | No |
| "Spec.-house" | Single family | 1 or 2 | No | Yes | Yes | Yes |
| Prefabricated house | Single family | 1 or 2 | Yes | No | Yes | No |
| Conventional house | Single family | 1 or 2 | Yes | No | No | Yes |

At the close of WWII, 20,000 housing units were built annually. By 1965, the construction of housing units was increasing steadily, finally reaching 190,000 units per year by 1973. Housing construction decreased to 132,000 units in 1974, partly caused by the oil crisis.² From 1976 to 1979 the units constructed reached 150,000, but dipped to 121,000 units in 1980. During the period 1974 to 1978 condominiums became popular among people, particularly in urban areas.

Prior to the oil crisis in Japan, housing construction rates increased by approximately 14% from 1965 to 1973, but production dropped to 0.8% during the period from 1973 to 1979.

Reasons for the decrease in recent housing construction in Japan:

- (1) The housing shortage which occurred after WWII has been largely solved, as basic demand in this area has been met.³



The Liaison and Protocol Section,
Bureau of General Affairs, Tokyo
Metropolitan Government, Sizing up
Tokyo, p.74.

- (2) Due to fewer marriages and less migration, the number of households has decreased

(Chart 1).

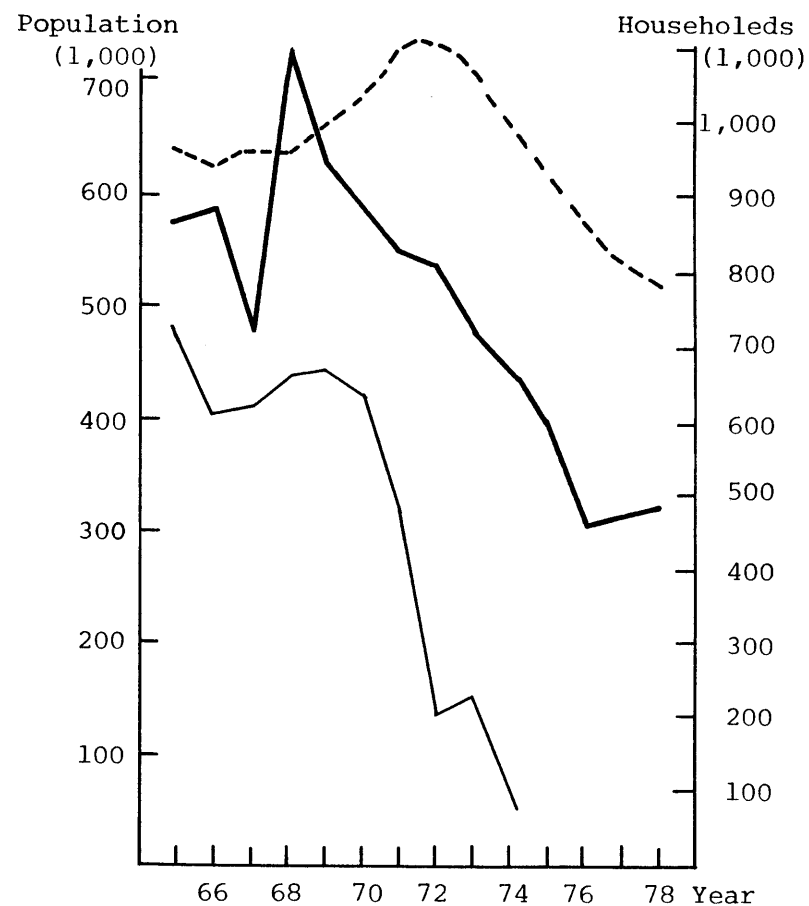
(a) The baby boom after WWII has reached marriageable age, peaked in 1972.

(b) Since 1970, the concentration of population in the cities has slowed down.⁴

- (3) The growth of personal income has slowed since the economy has entered into a slow growth period. The average yearly income (total worker's income after tax) increased at a rate of 12.4% from 1965 to 1973. Since 1974, it has gradually decreased with the rate stabilizing at about 8.5% from 1975 through 1979.

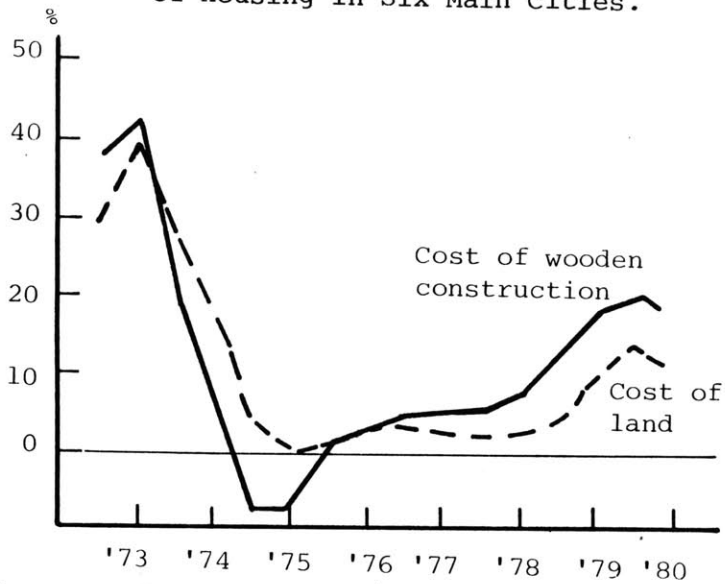
- (4) The skyrocketing cost of housing is the main reason for a decrease in housing demand.

Chart 1. Population Increase in the Main Three Cities, the Number of Marriages and Households Nationally.



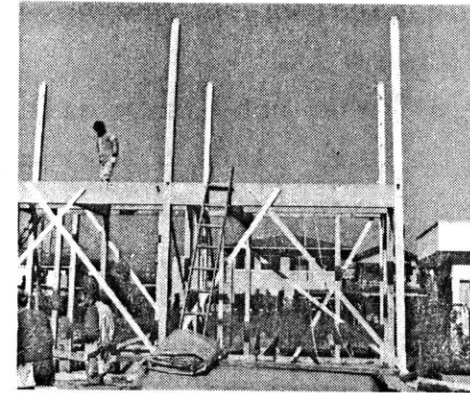
Source: The Minister's Office, Report of Population Changes.

Chart 2. Percent Increase in Cost of Wooden Construction Nationally and in Cost of Housing in Six Main Cities.



Source: Japan Real Estate Research Association, National Land Cost in Cities.

Land prices in 1978 and 1979 caused the sudden rise in housing cost (Chart 2).⁵ From the fall of 1980 to the spring of 1981, the prices for ready-built houses went up +18% and for condominiums went up +26%.



For 1980, the average housing cost for a single family dwelling was 21,750,000 yen on a national scale and 27,030,000 yen in the larger cities.⁶ The average ratio of housing cost over income per year in 1980 was 5.9 times on a national scale and 7.4 times in the larger cities, thus making housing acquisition very dif-

Table 2. Average Cost of "Spec.-house", Cost of Condominium, and Yearly Income per Household.

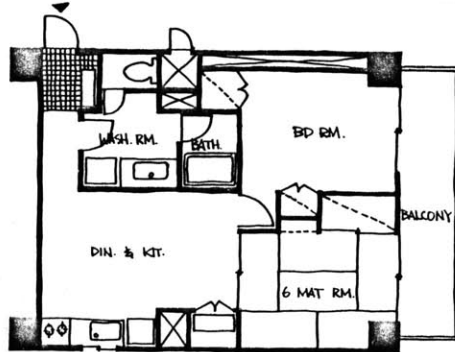
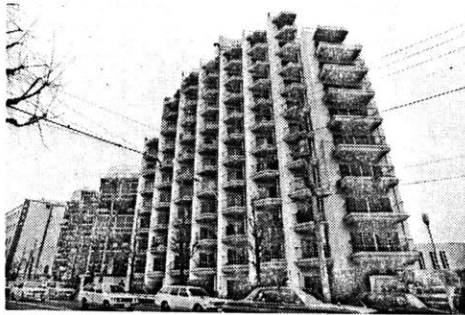
Units: 10,000 yen, (): %

| year | '73 | '74 | '75 | '76 | '77 | '78 | '79 | '80 |
|-------------------------|------------------|------------------|------------------|------------------|-----------------|-----------------|------------------|------------------|
| "Spec.-house" | 1,838 (61.7) | 2,017 (9.7) | 2,080 (3.1) | 2,024 (- 2.7) | 2,287 (13.0) | 2,481 (8.5) | 2,905 (17.1) | 3,428 (18.0) |
| Cost per income | 8.5 | 7.4 | 6.9 | 6.1 | 6.3 | 6.4 | 7.0 | 7.7 |
| Condominium | 1,158 (52.4) | 1,661 (43.4) | 1,507 (- 9.3) | 1,597 (6.0) | 1,643 (2.9) | 1,722 (4.8) | 1,964 (14.0) | 2,477 (26.1) |
| Cost per income | 5.3 | 6.1 | 5.0 | 4.8 | 4.4 | 4.7 | 4.7 | 5.5 |
| Yearly income/household | 217 (18.0) | 272 (25.4) | 301 (10.5) | 330 (9.6) | 359 (8.7) | 389 (8.4) | 416 (7.1) | 447 (7.5) |

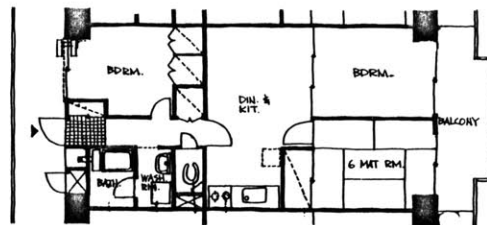
Note (): The percent increase over previous year.
Source: The Minister's Office, Real Estate Association and Real Estate Research Office.

ficult in the major urban centers. A comparison with the speculative house and the condominium shows that the speculative house is 7.7 times the average income, while the condominium is 5.5 times the average income, thus putting home purchase beyond the reach of most people (Table 2).

YOYOGI New Manshon
2 DK, Fully equipped. All
modern facilities. Large
balcony. ¥23,300,000.



MANSHON 2DK ¥58,250



MANSHON 3DK ¥37,500

Condominium

Japan External Trade Organization,
p. 21.

Trends in the following fields of housing includes: condominiums, speculative houses, prefabricated houses, and conventional houses.

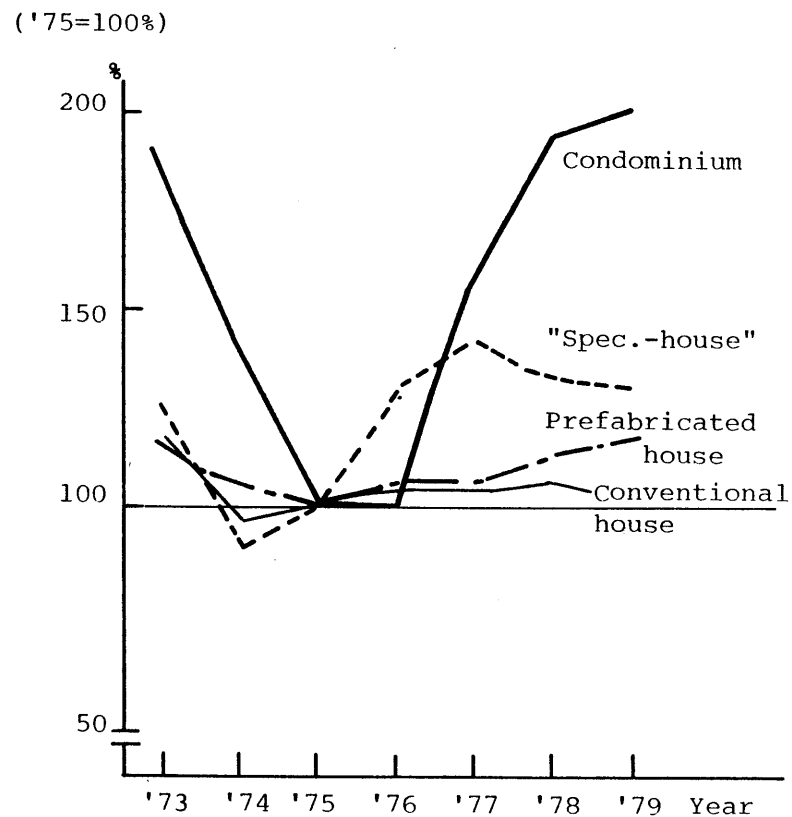
Demand is greater for condominiums than for speculative houses; similarly, the demand for prefabricated houses is greater than for conventional houses (Chart 3).

The demand for condominiums in major cities increased from 31% in 1973 to 41% in 1979. The reasons for a strong demand in condominiums are generally the following:⁷

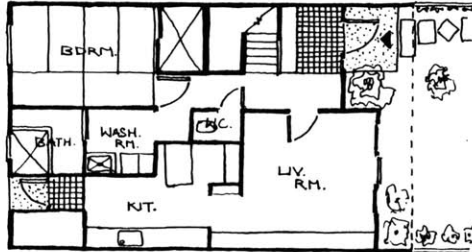
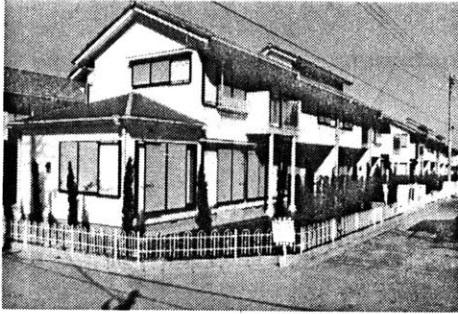
- (1) Condominiums are normally located near major cities, and thus closer to work and usually have good facilities as well as adequate maintenance.
- (2) The cost of a condominium is normally lower than a speculative house (Table 2).

- (a) The new family strata, i.e., ages twenty to thirty, has a possibility of buying a condominium by obtaining low cost loans from Kinyu koko (Housing Financial Corporation).
- (b) The land cost of a condominium is normally 40% of the total cost of construction compared to 60% for the "spec.-house". Since 1975, the cost of the "spec.-house" has been strongly influenced by land cost. As a result of this, the demand for "spec.-houses" has decreased relative to the condominium.

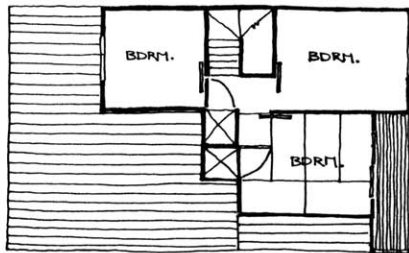
Chart 3. Construction Indexed to 1975



Source: The Minister of Construction, Statistics of the Number of Construction.



GROUND FLOOR TOWNHOUSE



2ND. FLOOR TOWNHOUSE

"Spec.-house"

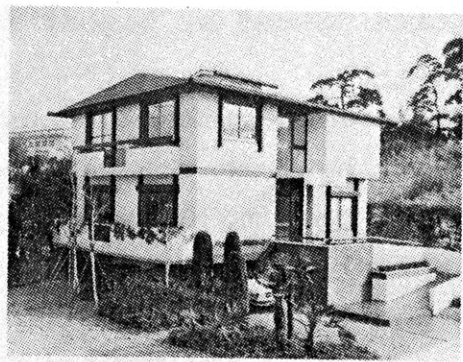
Japan External Trade Organization,
p. 22.

Every year acquisition of land has become more difficult. As a result, house builders have changed their policy in favor of building condominiums since it results in a more effective use of land.⁸

Detached, prefabricated housing has been recovering from a low construction profile (Chart 4). The single, detached, prefabricated house has been regaining its popularity the last two years. Industrialized products for housing are attracting a greater number of consumers.

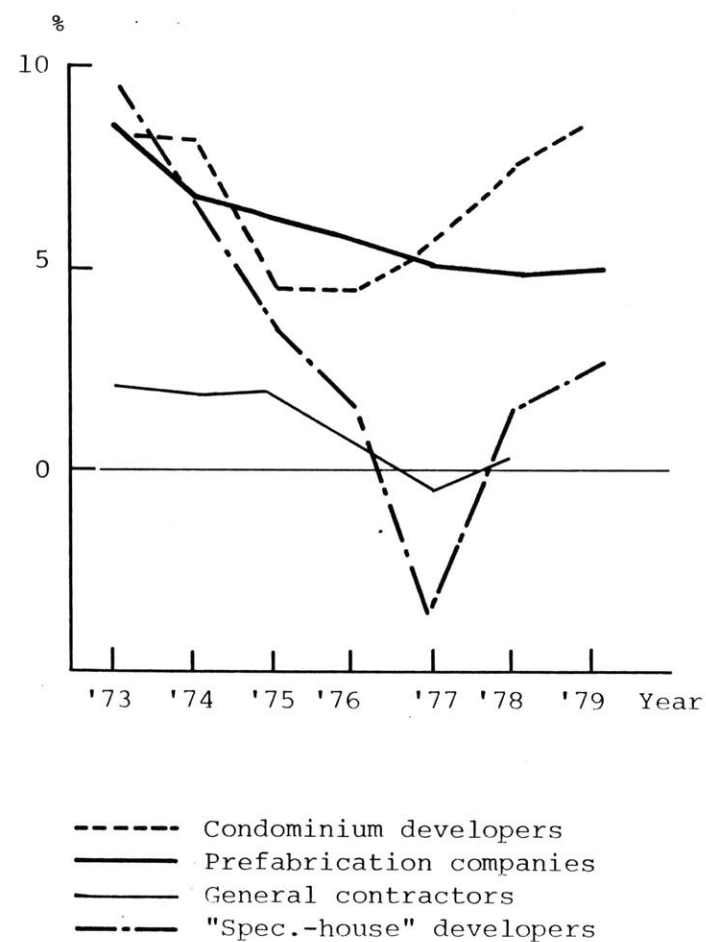
A yearly survey by Stusan sho of people who buy prefabricated houses shows that the motivation for buying a prefabricated house is that loans are easy to obtain and that the quality of construction sub-components improved by 1976. By 1976, prefabricated housing had improved substantially both in quality and design efficiency. The prefabricator made lower costs possible by standardizing

the house, by using fully efficient equipment, by updating exterior design and improving interior treatment. Because of these efforts and generally lower costs of the prefabricated house it became more popular than conventional housing.⁹



Prefabricated House
Misawa Home O-type, 1976.
Ono, Katsuhiko, Toshigata jutaku,
p. 119.

Chart 4. Profit and Margin: condominium, prefabrication, "Spec.-house", and conventional house.



Sources: Report on negotiable paper of housing companies, The Minister of Construction, Management Reports of Housing Businesses.

1.12 Summary

Demand for housing is determined by certain trends including: popular tastes, current architectural styles and family size. Housing demand changes are most often governed by changing family needs. The major changes of demand in housing lie in two areas:¹⁰

- (1) Moving to a larger house or rebuilding a house for more contemporary living on the same lot.
- (2) Increasing the floor area of new construction.

The statistics of the national housing survey (Jutaku koei shosa hokoku) by Sorifu shows that households which moved from current dwellings increased some +20% from 1974 to 1979 compared with a similar period from 1969 to 1973. Also Kohin jutaku kensetsu shikin riyo sha chosa (individual loan for single family house sur-

vey) by Jutaku kinyu koko (Housing Finance Corporation) indicated that the rate of re-building (ownership house) increased 20% in 1973 and 30% in 1979.

The reasons for increased demand for major changes in housing are as follows:¹¹

- (1) User demand for a larger house.
- (2) User demand for a better quality house made of better materials, improved plans and equipment for more contemporary living conditions.
- (3) The difficulty of land acquisition caused by higher land cost.

Since WWII, mass-produced housing has been built by both the public sectors (Japan Housing Corporation and Koei jutaku) and private developers throughout the entire nation. This type of housing provided a minimum of standard of space based on an "average" family (wife, husband and two children).

Presently the government is trying to reinforce and shift the quality of the living standard by stimulating the private sector. Better quality means primarily larger sized houses which meet contemporary living styles.¹² This can be partially validated by increasing the areas of houses each year (see Table 3).

Three reasons for increased floor area demand should be considered:¹³

- (1) Greater number of homeowners moving from apartments to a single detached house with a larger floor area on a subdivided lot.
- (2) Floor areas of newly built houses have been increasing 3% to 4% every year.¹⁴
- (3) The demand for adding more rooms has increased. This may be seen as awareness of the need for improving the quality of living of the Japanese people.

Recent construction in urban cen-

ters has decreased due to a lack of land availability, while new construction in rural areas has increased, mainly because acquisition of land in rural areas is still easier than in the city.¹⁵

The demand for changing and rebuilding houses will increase in the future and the above facts describe the housing situation, in terms of both demand and construction in Japan today.¹⁶

Table 3. Change of Floor Area

(Units: M²)

| Year | 65 | 70 | 73 | 74 | 75 | 76 | 77 | 78 | 79 |
|---------------------------|---------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Floor area per house | 59.7 (100) | 68.1 (100.1) | 76.9 (114.1) | 81.5 (136.5) | 82.9 (138.9) | 82.2 (137.7) | 84.1 (140.9) | 87.9 (147.2) | 91.4 (153.1) |
| A single family house | 80.9 | 94.8 | 104.2 | 120.0 | 104.2 | 108.0 | 110.0 | 113.8 | 118.5 |
| Rental house | 36.6 | 43.4 | 50.3 | 49.7 | 51.5 | 50.3 | 52.7 | 54.3 | 54.9 |
| Housing by companies | 59.8 | 66.6 | 77.8 | 74.9 | 78.9 | 77.7 | 77.7 | 79.7 | 81.6 |
| Housing on subdivided lot | 56.5 | 61.2 | 71.0 | 71.7 | 70.2 | 72.1 | 74.1 | 76.6 | 80.8 |

Source: The Minister of Construction, Report 1979.

1.2 User Requirement Profile

The life cycle of the Japanese family has been calculated to consist of six stages. This calculation has been made by measuring critical changes in furniture use as children's ages progress. A user requirement profile will be determined, using the Danchi (public housing) post-occupancy evaluation from 1960, and a survey of condominium applications done in 1978. In addition, required floor areas will be estimated, using the life stage hypothesis.

The majority of young families live in rented houses or apartments. A statistical survey in 1973 showed that on the national scale 60% of households were owner-occupied and 40% rented. The ratio is reversed in densely populated areas, such as Tokyo. Thus, the ratio of rented to non-rented houses increases closer to the cities¹⁷ (Table 4). Furthermore, the majority of

young families live in rented houses or apartments.

Many young families are in the low-income bracket and government housing policy does not meet their needs. People in this strata normally live in small rented rooms, rented houses or wooden apartments built by private sector builders. In Tokyo, 25% to 30% of the low income families live in small wooden apartments. The living

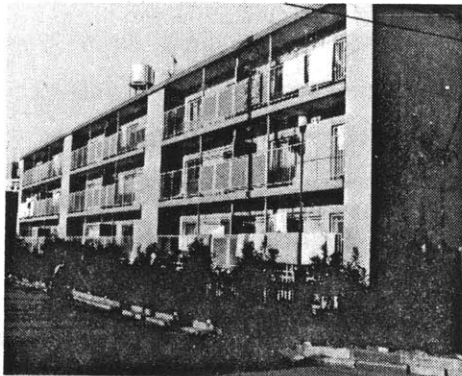
Table 4. Housing as Classified by Form of Tenure

| | Number of housing units in Tokyo (in thousand units) | Tokyo (%) | National total (%) |
|---|--|--------------|--------------------------|
| Total number of housing units | 3,504 | 100 | 100 |
| Owner-occupied houses | 1,382 | 39.4 | 59.2 |
| Rented houses | 2,122 | 60.6 | 40.8 |
| Public housing | 341 | 9.7 | 6.9 |
| Private wooden apartment houses | 1,072 | 28.7 | 22.5 |
| Private housing other than wooden apartment houses | 483 | 15.7 | 5.0 |
| Issued housing | 226 | 6.5 | 6.4 |

Source: 1973 Statistical Survey on Housing

Note: Total number of housing units covers those houses inhabited by persons.

condition of these private apartments is often far below that of public housing, Danchi, built by J.H.C. Moreover, living quality is getting lower each year in private apartments due to age deterioration, and low environmental quality (such as limited penetration of sun light into rooms), lack of facilities, and limited floor area.¹⁸ However, the rent is often twice to three times that of Danchi,



Apartment
Japan External Trade Organization,
p. 20.

especially in the larger cities. Within this context, people move to superior housing as income permit, from a rented room, to apartments built by the private sector, to Danchi by J.H.C. and finally to private houses.

A post-occupancy evaluation done in 1960 for Danchi shows this pattern clearly. Most of the residents occupying Danchi moved from other apartments or rented houses built by the private sector.¹⁹

Two reasons were found for moving:

- (1) Danchi has better facilities.
- (2) There were no suitable single family houses available.

Most of the occupants hold white-collar jobs while many blue-collar workers live in Koei jutaku, public housing by local public sectors.²⁰

The educational background of the husband is normally that of a University graduate²¹ and often additional space is needed for continuous study at home.

Many people living in Danchi look forward to the opportunity to "move up" to better housing.²² Important distinctions are found between blue-collar workers who see Danchi life as an attainment and wish to make the Danchi a community, and white-collar workers who see the Danchi as merely an intermediate stage with home ownership as the ultimate goal. The same attitude is found amongst people who live in condominiums.

In a survey on future living places, the question was asked "Where are you planning to live in the near future?" Approximately 60% answered that the condominium was a temporary living place and the ultimate goal was to live in a single family house.²³

Income and Family Size

A survey of condominium applicants in 1978 by J.H.C. revealed the following statistics: The number of family members changes relative to floor area. The number of family members is two for 3DK (51.9m²), three for 3DK (58.03m²), and four for 3LDK (66.63m²). The average monthly income of a family is between 210,000 yen and 250,000 yen per month for 3DK (total house cost is 12,000,000 yen to 14,000,000 yen) and between 310,000 yen and 350,000 yen for 3LDK (total house cost is 16,000,000 yen).²⁴

From these results, one can hypothesize that two- to three-member families bought 3DK and four-member families, (i.e., those over 35 years of age and married ten years or more), bought 3LDK.

From an analysis of these two examples, future owners of one family houses could be assumed to be relatively high middle income, white-col-

A second child six to nine years of age.

- Stage 4. The time the first child graduates from high school.
- Stage 5. The time the last child leaves the family when she/he gets married.
- Stage 6. Middle aged couple with or without adult or child. (Table 5 and 6).

The required floor area and type of plan for both communal and non-communal living are to be determined on the basis of each life stage using a government plan (Chart 6).²⁷

A single family without grandparents:

| Type | Range of floor area = m ² |
|--------------------------------|--------------------------------------|
| Stage 1: 1K to 2LDK | 21 to 81 |
| Stage 2: 1LDK to 3DK | 42 to 90 |
| Stage 3: 3DK to 3LDK | 59 to 100 |
| Stage 4 and 5: 3LDK to 4LDK | 68 to 111 |

Stage 6: 2LDK to 3DK 53 to 100
(Chart 7)

A single family with grandparents:

Stage 1: 2LDK to 3LDK 53 to 100
 Stage 2: 3DK to 4DK 59 to 105
 Stage 3: 4DK to 5DK 76 to 122
 Stage 4
 and 5: 5DK to 5LDK 87 to 132
 Stage 6: 2LDK to 3LDK 53 to 100

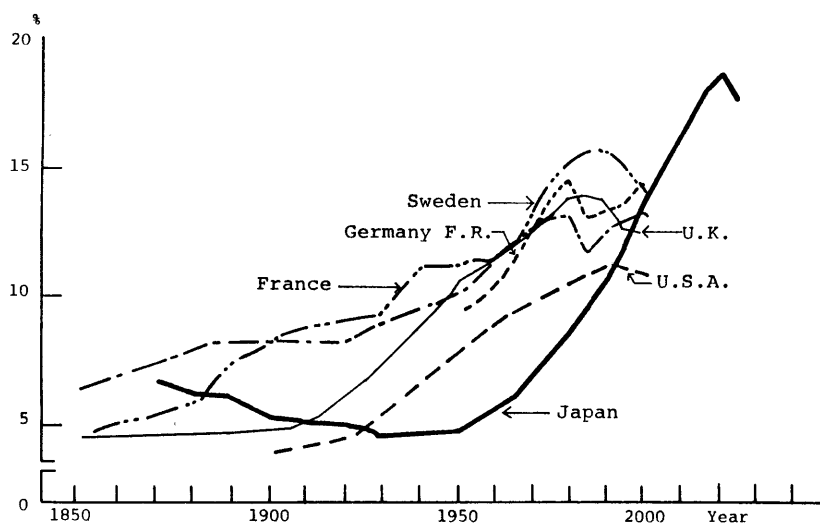
(Chart 8)

For life-cycle use, the housing must allow for changes: adding a new space, increasing and decreasing room size by combining or dividing the space, changing usage and decreasing space by renting to others.

The increasing presence of an older population group requires that this sector should be included in any future flexible housing scheme. An approach is needed that would accommodate expanding needs of the immediate family but would also include older members of the extended family.

The life expectancy of Japanese people has grown remarkably, reaching 72.97 years for males and 78.33 for females. The age structure of the Japanese has changed from a pyramid with a broad base in the 1930's to a more uniform distribution of the population as a result of both a decrease of the birth and death rates.²⁸

Chart 5. Proportion of Aged Population
(65 years and over)



Source: Bureau of Statistics, Office of the Prime Minister, Statistic Handbook of Japan (Japan Statistical Association, Mar. 1980, Tokyo) pg.20.

Chart 6.

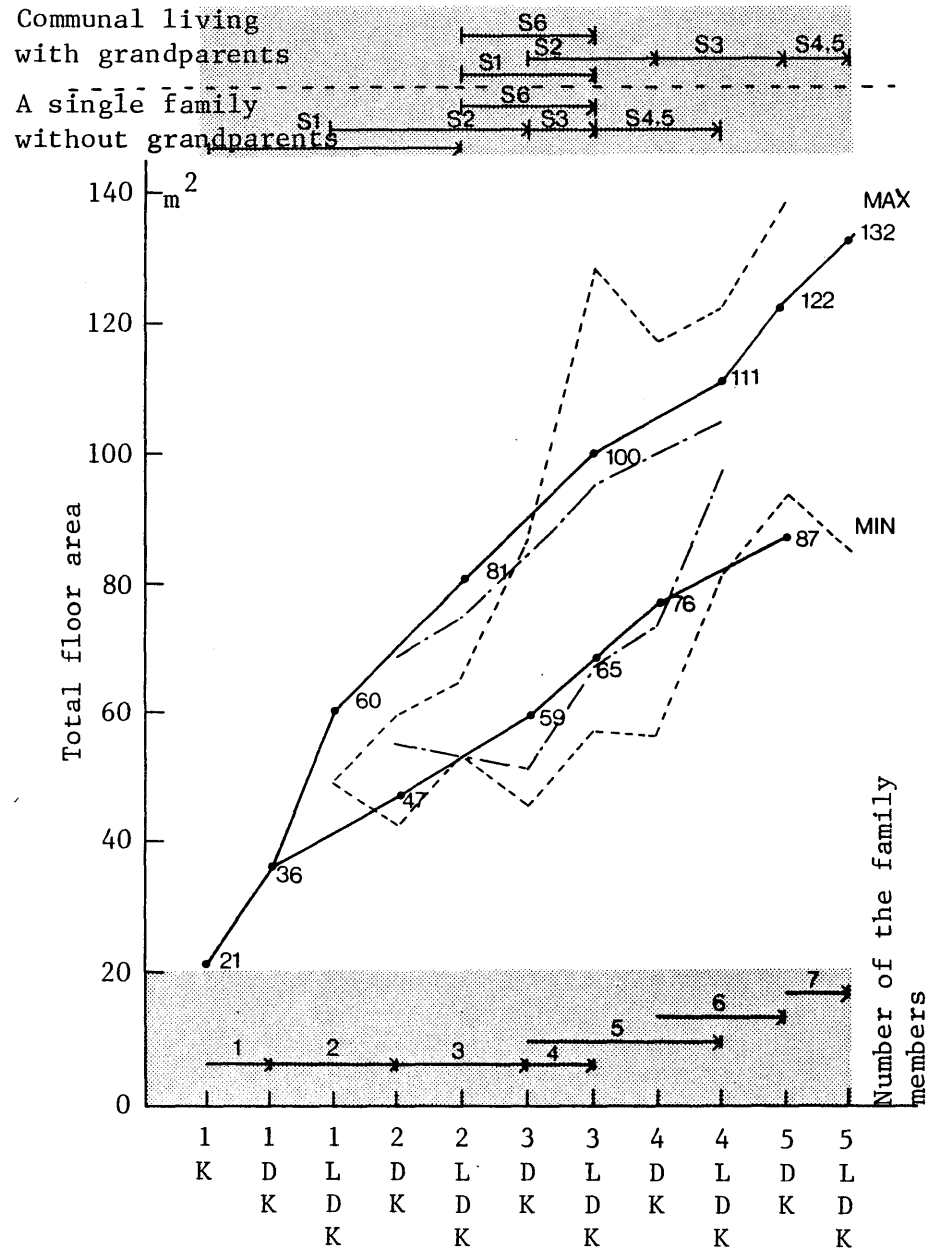


Chart 7. Required floor areas in each stage for a single family without grandparents.

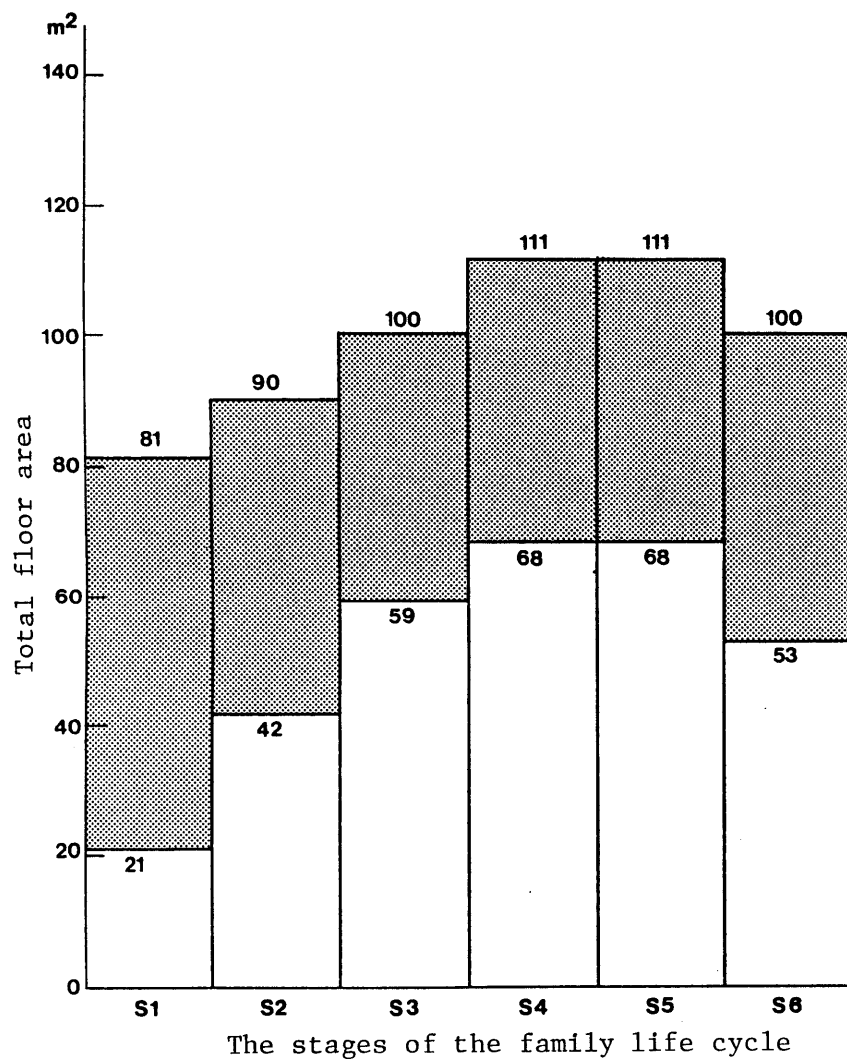
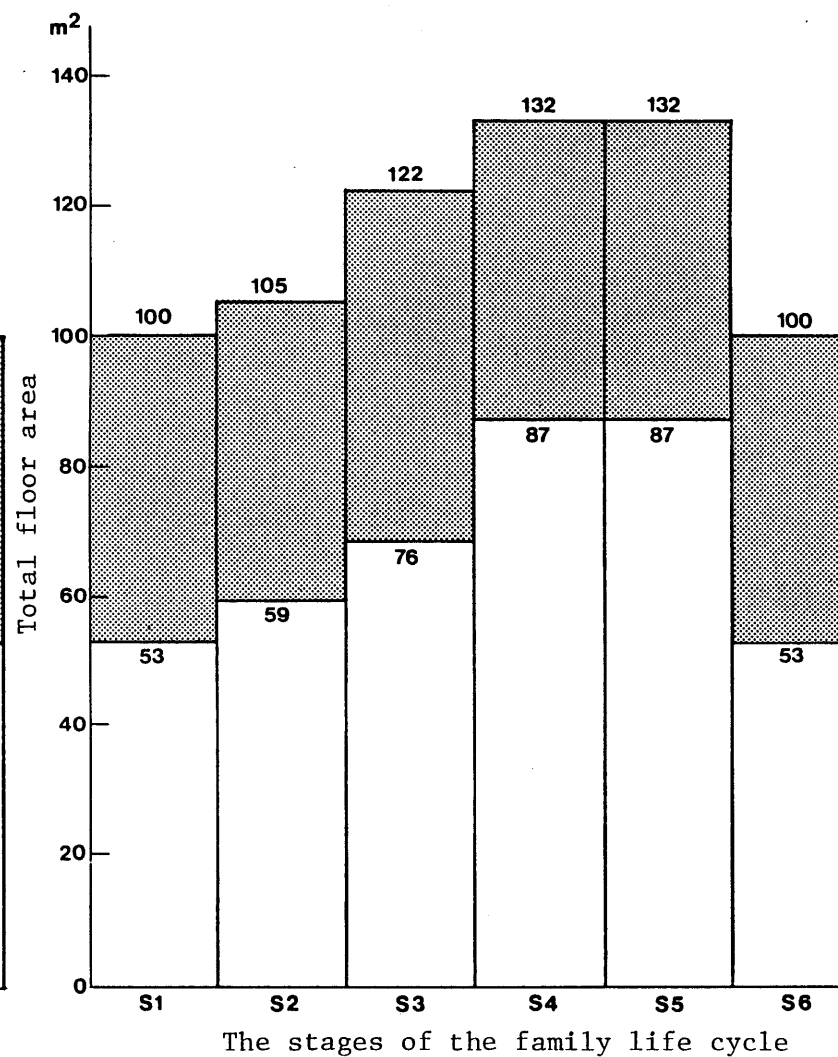


Chart 8. Required floor areas in each stage for communal living with grandparents.



NOTES

1. Mitsubishi bank, Chosa, v.311, March 1981, p. 16.
2. The Ministry of Economic Affairs, Keizai haku sho 1981 (Economic White Paper), p. 101.
3. Mitsubishi bank, p. 17-18.
4. The Minister of Construction, Kensetsu haku sho 1981 (Construction White Paper), p. 124.
5. Mitsubishi bank, p. 18.
6. The Ministry of Economic Affairs, p. 341.
7. Mitsubishi bank, p. 19-21.
8. Ibid., p. 21.
9. Ibid., p. 21.
10. Mitsubishi bank, p. 25.
11. Ibid., p. 25.
12. Ibid., p. 25.
13. Ibid., p. 25-26.
14. The Ministry of Economic Affairs, p. 109.
15. Mitsubishi bank, p. 26.
16. Ibid., p. 32; Hiroshi Izu, Nihon no jutaku jiyu (Tokyo: Gyosei, 1979), p. 38-46.
17. The Administration of the Tokyo Metropolitan Government, Plain talk about Tokyo (Tokyo: The Tokyo Metropolitan Government, 1980), p. 74.
18. Ibid., p.78-83; Izu, p. 58-60.
19. Naribumi Suzuki, Shugo jutaku (Tokyo: Maruzen, 1975), p. 110-113.
20. Ibid., p. 110.
21. Ibid., p. 111.
22. Ibid., p. 113.
23. The Minister of Construction, p. 126.
24. Japan Housing Corp., n.p., nd.
25. Izu, p.178-183.; The Ministry of Economic Affairs, p.353.
26. The determination of the stages of life for the Japanese is based on research by Naribumi Suzuki (Shu go jukaku pg.180). The stages of life have been further modified based on the advice of Sandra Howell (Professor of Behavioral Science in Architecture, MIT)

27. This chart compares the government's guidelines of housing requirement to actual housing projects built by both the private and public sectors. The portion of the chart covering the government's guidelines was generated from a numerical table developed by the Minister of Construction (see Construction White Paper 1981, pg.145). The chart also includes the space required in each stage of life by single families both with and without grandparents.

28. Statistics Bureau, Prime Minister's Office, Statistical Handbook of Japan 1980 (Tokyo: Statistics Bureau, Prime Minister's Office, 1980), p.16-23.

2 LIFE STYLE AND CHANGES

- 2.1 House, Family, and Home
- 2.2 Privacy in the Family
- 2.3 Woman and House
 - 2.31 Change in Woman's Role
 - 2.32 Correlevant Changes of Housing Design

House, Family and Home

家 IE* (IE)

Definition of a house:

- A physically built volume used for human habitation.
- My place to live.
- The place where a family lives.
- Katei.
- Kin group, family-line, rank of family.

家族 IE + Kin* (Kazoku)

Definition of a family:

- People who have a blood relationship and who live together in the same dwelling place.

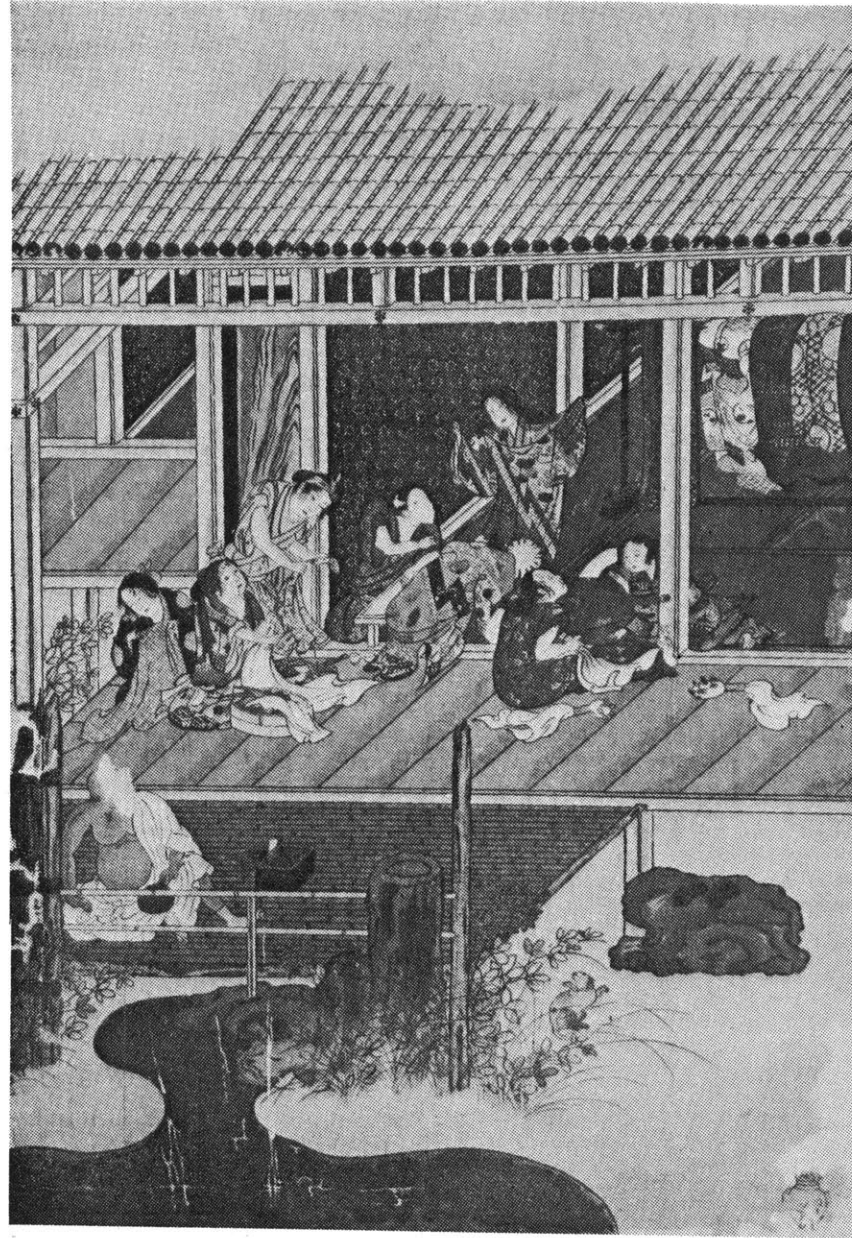
家庭 IE + Garden* (Katei)

Definition of a home:

- A small group of people who are blood related such as a wife and husband; parents and children who live together.¹

Note

- * : A composition of Japanese character.
 (): Japanese pronunciation.



Indoor Life

2.1 House, Family and Home

Each word in the Japanese language is a symbol for a concept and therefore presupposes an awareness of the nature of this concept: therefore we have Ie, Kazoki, and Katei - House, Family and Home.

Ie and Kazoku: House and Family

The combination of the Japanese characters Ie and kin makes the word for family; Ie and garden makes the word of home. Ie, thus, plays a central role in the meaning of house, family and home in Japan.

Indeed, the whole framework of the Japanese way of living, the way they think, their culture and even labor relationships are strongly related to this Japanese "Ie" system. As defined by Chie Nakane, anthropologist, Ie is:

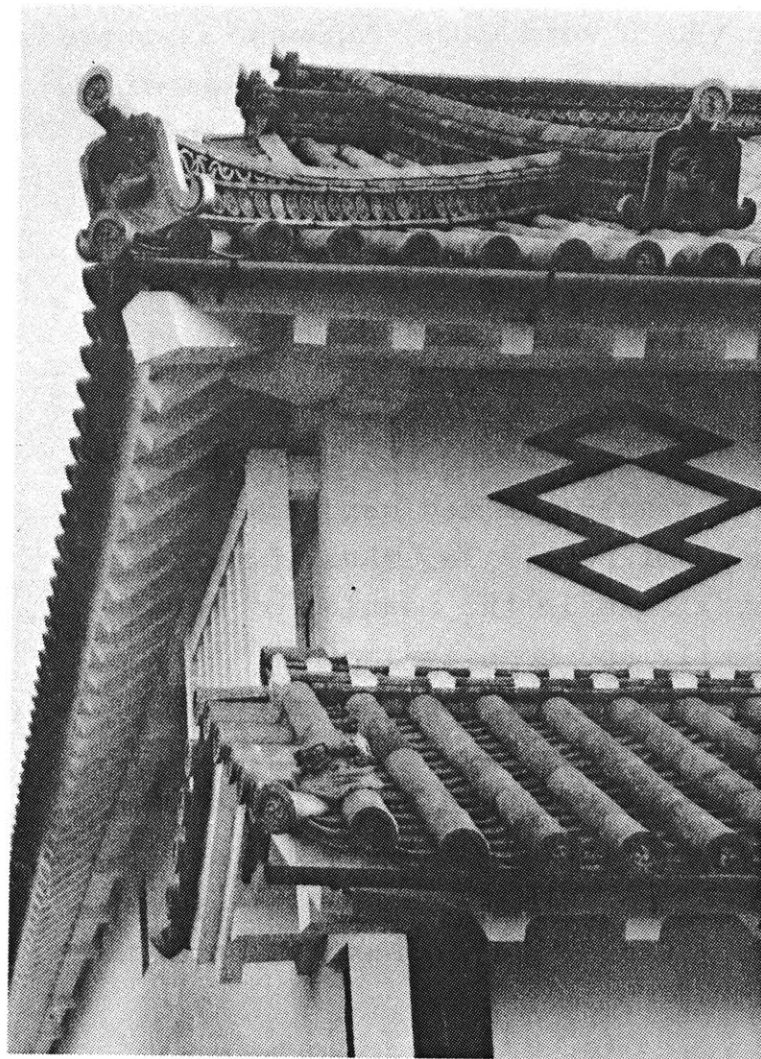
"a social group constructed on the basis of an established frame of residence and often management organization"²

It is of primary importance in the individual household and to a somewhat lesser extent in the kin group as a whole. The significance of "Ie" is not confined to the physical structure, but extends to the dependence between man and shelter. "House" in Japan has retained its original integrity: that is, the oneness of shelter, family and man.³

Ie is a special Japanese culture system which developed in the middle of the Edo period and prospered at the end of the Edo and Meiji periods.⁴ It has been diminishing in importance since WWII, partly as a result of the new constitution which changed the family system from a patriarchal to a nuclear family.⁵ However, the traditional idea of family and the conceptual understanding of Ie still have an important impact on family behavior. At the heart of the system was the Ie, the single unbroken

family line, including both living and dead, and the concept of filial piety. The basic goal of Ie members was to care properly for departed ancestors and to preserve the continuity and prosperity of their Ie. Preservation of Ie is the most important duty for the family.⁶ The status of Ie is indicated by the possession of materials and elaboration of house. Therefore, the house represents prosperity of their Ie. Thus, the house where the Kazoku (family) lives is the primary concern of the "Ie" concept. The secondary concern is the family who share the place, including non-family members. The "family" includes all people who live in the house; this notion is embodied in the Japanese term "Uchi no moro (people in the house)".⁷

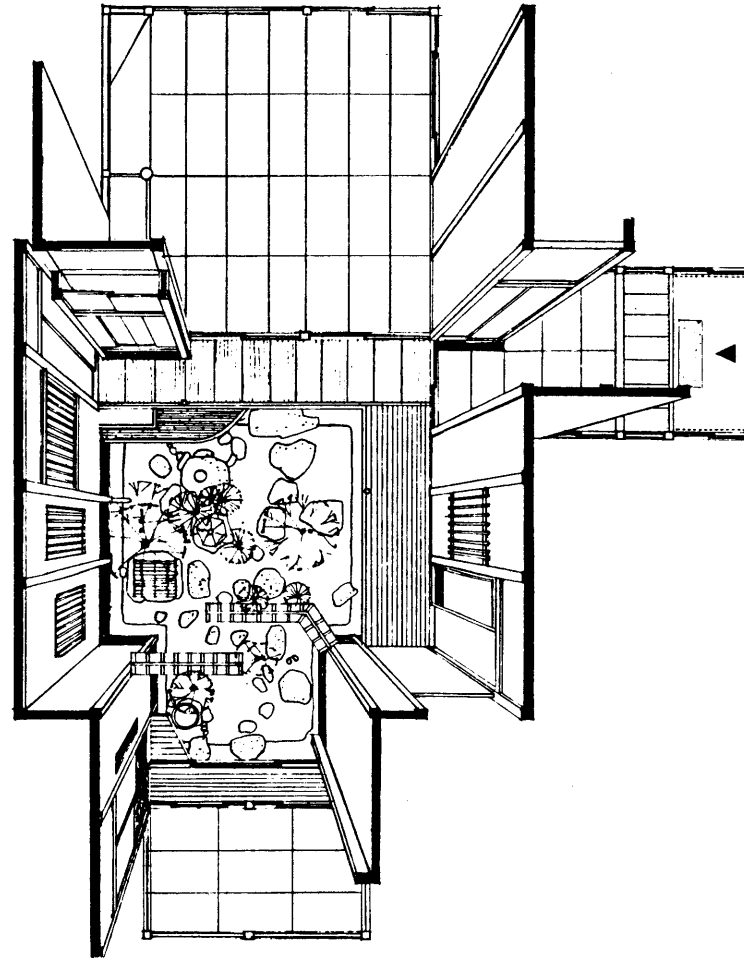
"Family in building is the collective body of persons who form one household under one roof. It consists of descendants of a common progenitor and includes servants" (Engel)⁸



The Family Insignia
Minka, p. 21.

Katei: Home

Ie and garden makes the character of Katei (home). Both the traditional Japanese house and the more modern house have often been associated with a garden regardless of the size and the location of the structure. In ancient times, the character of "Tsubo" was identified as a garden within the housing structure.⁹ It referred to an open space surrounded by buildings and a space between buildings. This space was for private use by the family and others closely related to the family.¹⁰ For the obvious reasons, a garden is an especially important space in Machiya (high density row house in the cities). Tsuboniwa (also garden) has a primarily functional purpose: ventilation, intake of light, as a divider, for a release of odors from adjacent rooms, and for appreciation of nature.¹¹ Machiya in fact, became potential living spaces only because of the Tsuboniwa.



Tsubo niwa
Kyo no tsubo niwa, p.165.

The garden can be seen as a room in nature. It gives interest to space organization while at the same time providing comfort for indoor life. The garden exhibits both beauty and calmness. Tsuboniwa is the pool of light and air, giving sense of seasonal change and adding pleasure to the observer's eyes. It greatly enriches the living space and reflects the daily life and life style of the people who occupy the house.

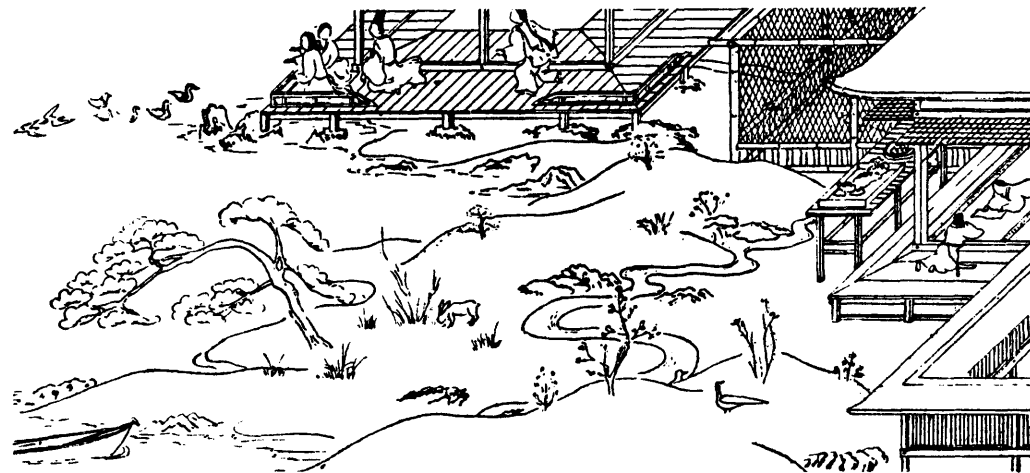
The names of Kiri tsubo, Fuju tsubo, and Ume tsubo, were given to the place where a lady lived which appeared in

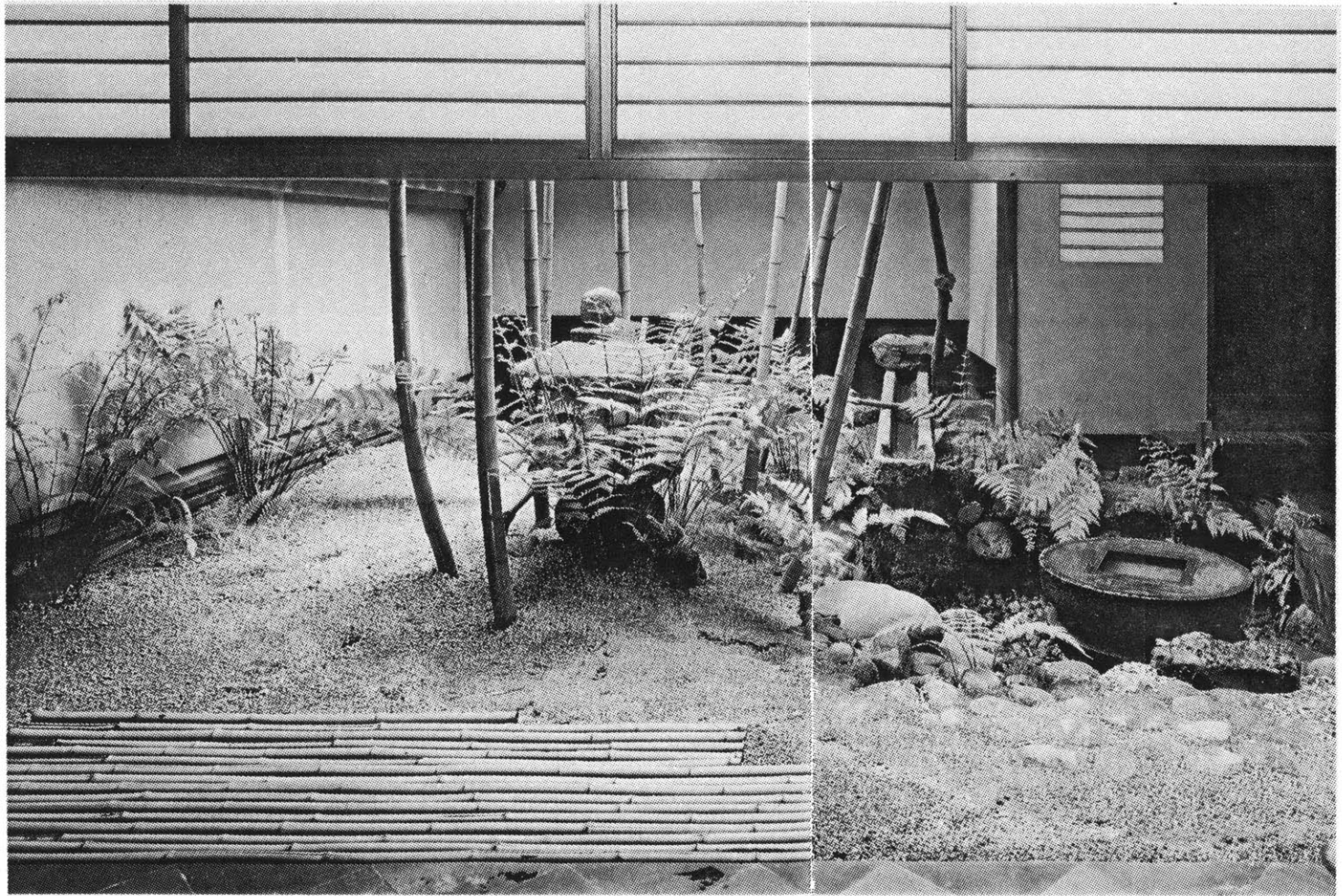
the old literature "Gengi monogatari" by Shikibu Murasaki. A garden thus suggests femininity in contrast to the male image presented by the house.¹²

Basic human life is understood and incorporated into the global meaning of Katei (home: house and garden) as one integrated unit.

The garden and house are intimately interrelated in the Japanese cultural milieu. The garden exists because of the house and the house becomes liveable due to the presence of the garden.

Genji built a garden for Murasaki, his wife. Heian Period (794-1185). Japanese Garden for Today, p. 14.





PRIVACY

Definition of Privacy:

- Originally did not exist in Japanese language.
- Personal matter which is not to be known by others.
- Seclusion
- Personal life¹³
- Secrecy¹⁴

2.2 Privacy in the Family

"For only in the healing and sometimes illumination moments of privacy can a man make himself truly fit to live with others." (Time, 1966)¹⁵

The word "Privacy" does not exist in traditional Japanese language. This philological difference between Japanese and Western languages also surfaces in the social structure of the Japanese family. Modernization in Japan has been based on and affected by a combination of the Japanese mentality and Western knowledge. Modernization should be seen in relation to the existing political and social configuration: modernization has been carried out not by changing traditional structure but by utilizing it.

The modern notion of privacy is distinctly a Western tradition. Definitions by Chain (1951), Kira (1966), and Kuper (1953) emphasized seclusion, withdrawal and avoidance of interaction, where a person or group seeks to remove themselves from contact with others.

Westin (1970); Rapoport (1972); Proshansky, Ittelson and Riblin (1970); and Simmel (1950) emphasize the concept of control, of opening and closing of the self to others of freedom of choice and options regarding self accessibility to others.¹⁶ Irwin defined privacy as: the selective control over access to the self or to one's group.¹⁷

In terms of privacy in the family and dwelling, Flex emphasized the necessity of privacy as adequate insulation between family members and furthermore he noted that without adequate insulation the family will lose much of the spacial intimacy which holds it together. It would not be able to effectively carry out its traditional functions.¹⁸ Physical opportunities available for privacy have significant implications for determining the quantity of interpersonal relations which arise within the family group.

1. Periods of privacy, i.e., physical isolation from other members of the family represent a basic need within each individual. Such privacy is important to the development of subgroup relations within the family and to the development of adequate personality.
2. Spatial limitations imposed by the family dwelling are important in structuring patterns of privacy and interaction within the family.
3. As the size of the family increases the spatial limitations imposed upon the family interaction patterns by the dwelling become flexible and more deterministic. (Felix)¹⁹

Spatial organization of residential design in Western cultures reflects these concepts of privacy which are achieved by separation of individual rooms using fixed walls, a lock on each door, design-

nating by name each space, such as main bedroom, children's rooms etc.

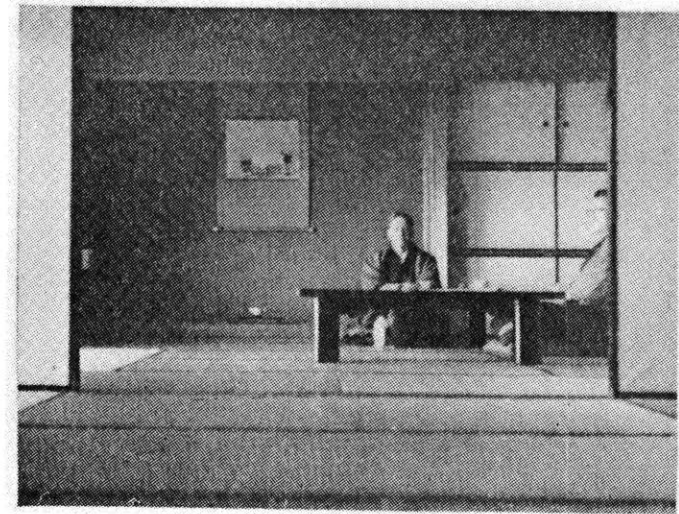
In the United States, strong emphasis is placed on ensuring the privacy of each family member. This led to the separation of family members rather than holding the family together.

"Even within the family, Americans are unique in their feelings that each member should have a separate room and even separate telephone, television and car, when economically possible. We seek more and more privacy, and feel more and more alienated and lonely when we get it. What accidental contacts we do have, furthermore, seem more intrusive, not only because they are unsought but because they are unconnected with any familiar pattern of interdependence." (Slater, 1970)²⁰

In the process of modernization, Japan imported many Western cultural elements. Although the Western idea "privacy" is found in modern Japanese housing design, the notion of privacy itself has not had a significant effect on actual Japanese life-style.

"It is like language with its basic indigenous structure or grammar which has accumulated a heavy overlay of borrowed vocabulary. Here is an example of industrialization and the importation of Western culture not effecting changes in the basic cultural structure. While the outlook of Japanese society has suffered drastic changes over the past hundred years, the basic social grammar has hardly been affected." (Chie Nakane)²¹

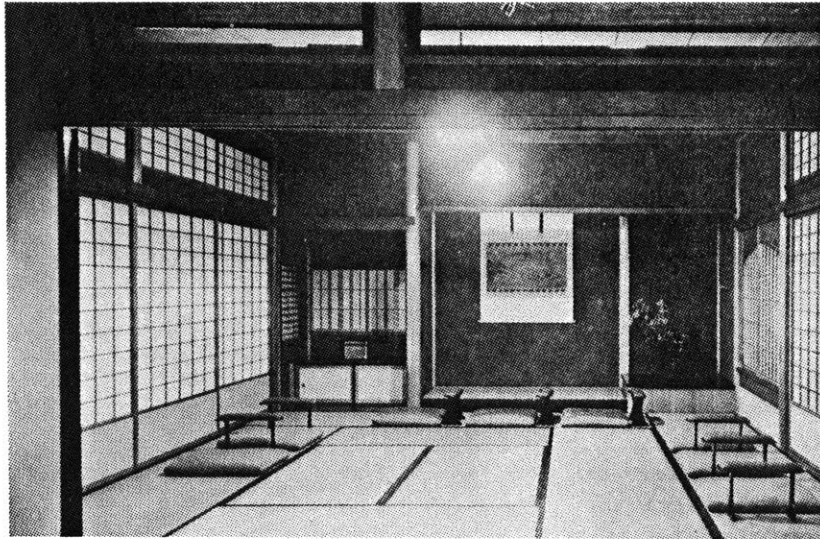
There are two aspects which result from this non-existence of "privacy" in the Japanese language: One is the social structure, the concept of Ie system and the other is the traditional building system which developed around the major principle of Japanese housing design: house for summer living.



Social Characteristics

In Japan the frame of social structure is based on a vertical relationship which binds a set of individuals into one group as in the family.²²

In the Japanese system all members of the household exist in one group under the authority of the elder male, with no specific rights accruing to the status of individuals within the family. In Japan people are always based on the collective group, Ie, members of a household, not on the relationships



Ranking in the seating arrangement.

between individuals. The social group, the 'household,' acts as the ultimate integrating power, a power which restricts each member's behavior and thought, including the household head himself.²³ In traditional Japan, emphasis was placed mainly on the harmonious integration of family rather than individuals, and a strict ranking order of the family and their space use in the traditional house are manifested in Japanese daily life. There was no place a family member could have privacy or a private life in the traditional

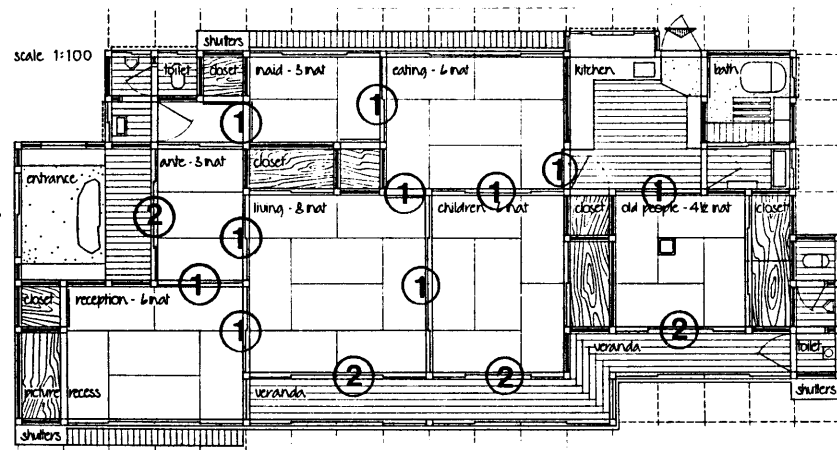
Japanese house due to its space organization, and the use of movable space dividers (Fusuma). The head of the household had total control of the house, a system which was supported by the ethics of the patriarchal family system.

Rank is the primary social norm on which Japanese life is based. In a traditional Japanese house the arrangement of a room expresses this gradation of rank and clearly prescribes the ranking differences,²⁴ which are to be observed by those who use it.

Physical Characteristics

"A house should be built for living in summer climate." (Tsure tsure gusa, Kamakura period)²⁵

One of the characteristics of the Japanese house is that it is made for summer living.²⁶ Wooden frame construction has been developed, using the concept of an open plan for summer living. The Japanese dwelling-house has developed as a response to the special climate of Japan and according to the principles of the traditional Japanese ways of life. The Japanese dwelling-house is characterized by its special adaptation to climatic conditions, its economical use of space, its frugal spacing demand on building materials, its economical and natural construction methods and use of building materials. Everything is logically thought out and little scope is allowed to the vagaries of mood and fancy.



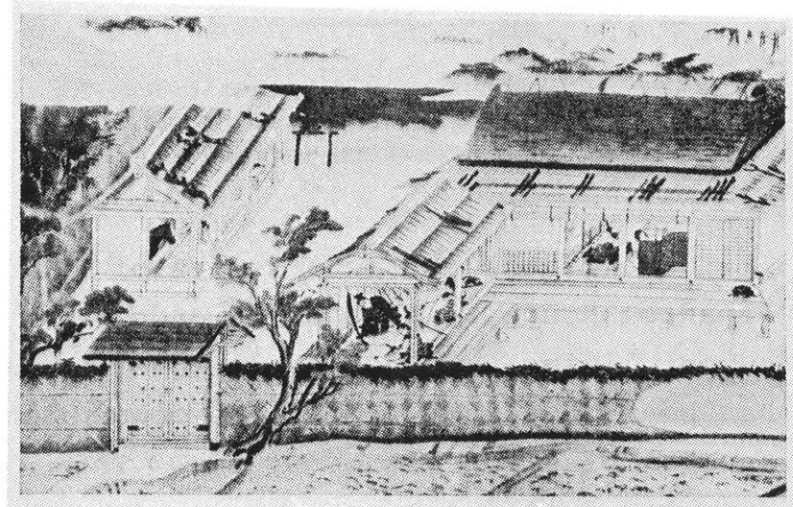
Legend:

- 1: Fusuma
- 2: Shoji

Fusuma and Shoji (both movable partitions) are used as walls which can be removed in the summer time, and Ranma, an open screen type, above the Kamoi (beam) between the rooms, is used for ventilation purposes. All these secondary elements have no acoustical separation value. There was

little control of accessibility due to movable partitions which were located on at least two sides of the room.

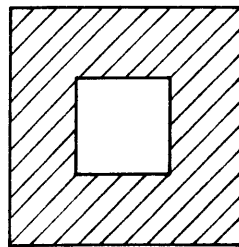
Thus, the combination of physical construction and the Ie system in Japanese housing could not support a concept of "privacy" in the sense of an individual's isolation in the house. Instead of developing "privacy" in a Western manner, the Japanese developed behavioral mechanisms which allow them to conceal emotions within themselves by developing extremely sensitive interpersonal manners, controlling facial expressions and posture, etc. Such delicacy of behavior tends to be couched in a certain ambiguity of expression, for reasons of self-defence and to conceal hostility.²⁷ The acquisition of these extremely delicate ways of conducting personal relations requires considerable social training, though most Japanese achieve them through their social life from childhood onwards and reinforced by the imposi-



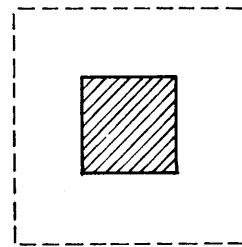
tion of the open plan, unlocked and removable sliding doors (Fusuma and Shoji), which provide no acoustic separation within the house.

However, the idea of strong protection of one group (family) from others grew out of the tradition of a "frame base" society.²⁸ Efforts to achieve privacy between the family and its surroundings include the creation of gardens, the use of high walls and fences, landscaping and curving the entry path from the public street.

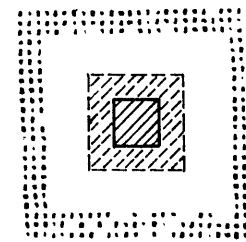
When the urban commoner's house eventually assumed an open front and rear, the enclosure that came to be known as the Tsubonouchi was required as a kind of shield to protect the privacy of the family. At the same time it offered the advantage of providing space for constructing a small garden. According to a record of 1487, for instance, a single residence was made up of a number of conjoined structures, and the largest such residence had no fewer than seven components. When a residence consisted of a number of households of both relatives and non-relatives living together, a walled enclosure like the Tsubonouchi was still necessary to insure privacy.²⁹



Arab court house



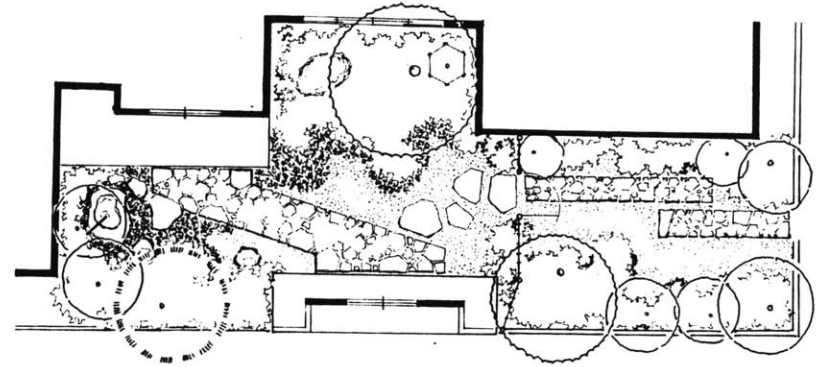
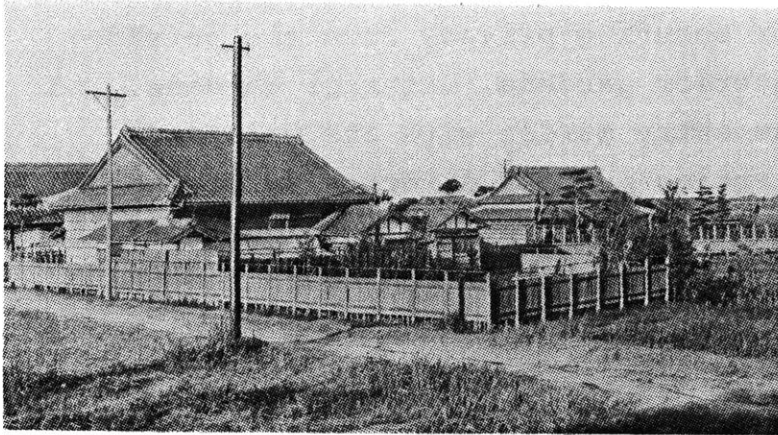
American house



Japanese house

The traditional entry garden is used for ensuring privacy from the outside. Interior gardens, exterior gardens, and the entry garden with its wall and planting cut any direct view of the house from the outside.³⁰ It provides comfortable living both within the house and the garden, which are conceived as an organic whole.

The wall or fence should be regarded as the real exterior wall of the Japanese house with its open plan and its simple system of construction,³¹ to provide comfortable living in the summer. Gardens in many foreign countries often do not have either walls or fences. On the other hand, summers in Japan compared with other



Treatment of the Entry

countries are usually very hot and humid. Therefore free movement of air must be facilitated, which has led to the evolution of the open plan. To protect the open plan house, the garden has been enclosed by a wall and a fence. Houses in Western cultures generally use "closed" construction without walls or fences outside. Thus the garden may be also enjoyed by the neighbors. This public display is reflected in the treatment of gardens in the West.

In traditional Japanese houses, the entrance is never placed directly opposite the garden gate, to avoid a direct view from the street into the interior of the house with its very open aspect. The path connecting the garden gate and house entrance therefore runs diagonally or forms a curve, such as an S or L shape.³²

All these efforts were made to ensure privacy of the family from others while the family members themselves were held together and controlled by the head of the household.





- 2.3 Woman and House
 - 2.31 Changes in Woman's Status and Role.
 - 2.311 Women's Role Before WWII.
 - 2.312 Post-war Changes
 - 2.313 Rural vs. Urban
 - 2.314 Housewifery
 - 2.315 Danchi Life and Child-care
 - 2.316 Women in Japan vs. the United States



2.31 Changes in Woman's Status and Role

Both the family in particular and society as a whole have had a strong influence on Japanese housing design since World War II. The organization of the Japanese house reflects the role that individuals play in the family. This is especially true for Japanese women, whose role has been changing drastically in this country.

Higher status, better education and improved working conditions of Japanese women since World War II have almost certainly had a great influence in changing housing design. Thus, an analysis of women's place in the home should provide important insights into both existing and future housing design.

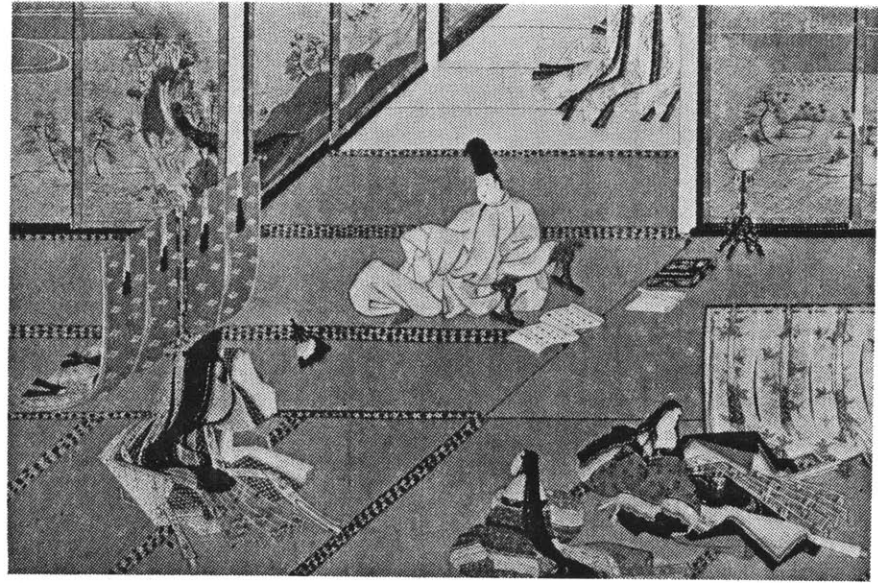
2.311 Women's Role Before WWII

Before WWII the traditional image and status of Japanese women was heavily influenced by Buddhism, Confucianism, and by Samurai ethics. After WWII the patriarchal system was discarded and the role of women changed dramatically. This change was spurred by the introduction of democracy, the expansion of industry and urbanization, and the spread of the nuclear family.

There is no record of a matriarchal society in the annals of the country. However, in Japanese mythology women held positions of considerable power, and there is even evidence that there were female gods:

"The sun goddess Amaterasu, the shrine honoring Japan's supreme deity, is pervaded by a sense of Japan's mythic feminine cosmogenesis and matriarchal antiquity."

(Joyce Lebra, Joy Paulson,
Elizabeth Powers)³³



Three major factors having the greatest influence on women's role in society were the introduction of Buddhism and Confucianism from China, and democracy from the United States.³⁴ The close ties between Japan and China for the past fifteen hundred years have had (and continue to have) a strong influence on Japanese thought and culture. Reflecting the presence

of both Japanese and Chinese thought, strong-spirited female deities, as well as repressed wives, appear in ancient literature (see Kojiki and Hihongi).

The lower status of women did not change until the end of the Tokugawa period (1600-1867).

Chinese Buddhism expressed a negative attitude towards women, a negativity which contradicted the generally positive and humanistic attitude of the religion.³⁵

"Buddhism taught that woman's nature was inherently evil, labelling her as temptress. Buddhism attached female sexuality- "Woman is a creature with the look of an angel... but a diabolical spirit in its heart" and "woman is full of sin; nothing is to be dreaded so much as a woman." Even today, the proverb "Behind the crime is a woman" reflects the Buddhist image of women".

(Joyce Lebra,
Joy Paulson,
Elizabeth Powers)³⁶

The rulers during the Tokugawa period (1600-1867) emphasized Neo-confucianism in their effort to establish a society based on the relationship between inferior and superior persons. Ieyasu Tokugawa officially adopted Confucianism. Neo-confucianism emphasized performing one's duty according to one's place, and maintaining proper human relationships as defined according to certain basic relationships: lord and subject, father and son, and husband and wife. Women's role and status was established within this framework.³⁷

The family and not the individual was the basis of social status system, and individuals were ranked by their standing within the social system. The social system is reflected in the traditional Japanese house. The traditional Japanese house developed under the influence of Shoin zukuri (warrior's house).³⁸ The organization of the traditional house was more a

reflection of rank, social position and custom rather than expressing use and function.³⁹

In addition, Kaibara Ekken (1631 to 1714), the Neo-confucian scholar, and writer of moral tracts intended for dissemination among the common people, significantly defined the role of women. This book, Onna Daigaku (Great Learning for Women) became part of nearly every Japanese household. Its "wisdom" was taught to most Japanese women. The Great Learning for Women contains the following instructions:⁴⁰

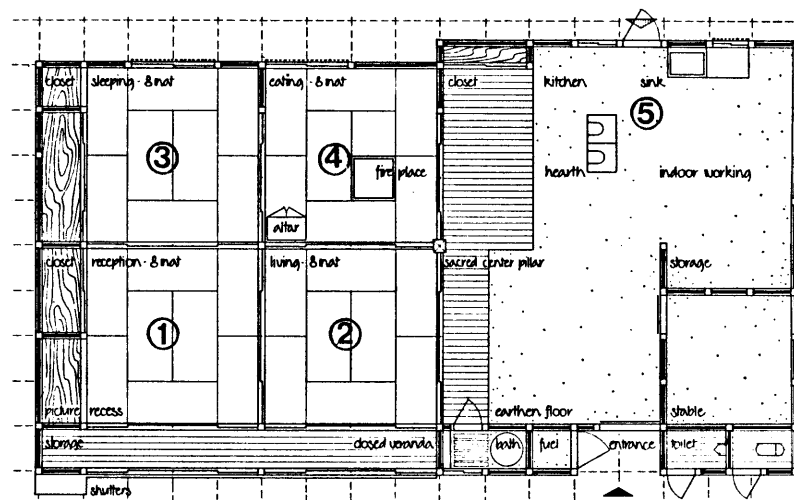
- Women should be mentally suppressed in the interest of the family system.
- Marriage was the only acceptable condition for a woman. Thus, the sole purpose of her education should be learning how to please her husband and especially his parents.
- Women were encouraged to remain within the home. This included

the exclusion from attending religious ceremonies.

This book reinforced the feudal aim of perfecting the hierarchy within the basic social unit, i.e., the family system.

Generally, the traditional Japanese house is known for its flexibility and interchangeability of plan. This is only true for the wooden frame building system, and not for the uses within the house. The farm house shown is an example of Minka, one of the oldest house types. The house was governed by the ranking order of guests and family members and strict rules of conduct. Within the house the reception room (Zashiki) is the most important of all rooms, and it is reserved for ceremonial occasions and the entertainment of guests. The use of the reception room is related to the "Ie". Family members hardly ever step into this room. Even the seating arrangement around the fireplace (Irori), the most informal gathering

spot in the house, expresses people's rank.⁴¹ As a rule, the higher the status of the space, the less one senses the presence of women.⁴² Even after the end of the feudal system, women's role within the family remained largely that of a domestic servant. She provided labor for the family by preparing the food, making clothes, cleaning the house, and entertaining guests. In rural areas, her duties often included being a farm hand as well. The role of Japanese women during this period was similar to that of most women around the world. The role of Japanese women remained unchanged until the end of WWII.

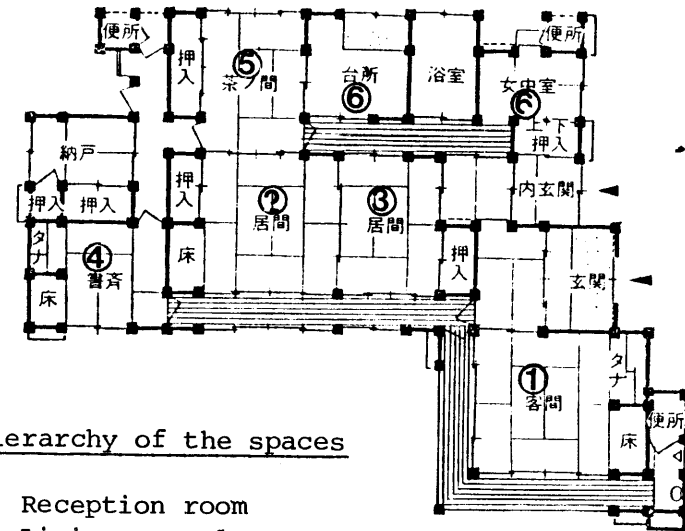


Hierarchy of the spaces

1. Reception room
2. Living room
3. Sleeping space
4. Eating place
5. Kitchen

Meiji Period (1868-1915)

The Meiji government drafted a civil code that made the conjugal relationship of the husband and wife the basis of the family. The marital union of a man and woman led Japanese society away from the patriarchal society and toward the nuclear family. However, the extended patriarchal family continued for many generations and did not end completely until after WWII. During the Meiji period, recognized roles for women were restricted to the rearing of children and family service.⁴³ A hierarchy similar to that of the family can be seen in residential design. All of the rooms in the house were ranked in order of importance by the head of the household. The architectural elements, e.g., frame construction and movable interior partitions, did not indicate the hierarchy of the space. Rather it was through the spatial organization



Hierarchy of the spaces

1. Reception room
2. Living room 1
3. Living room 2
4. Den
5. Eating place
6. Kitchen and maid's room

of the entire home that this hierarchy was established. The reception room was the most important among the family spaces and its significance was expressed through its location and physical elements, such as the Toko-noma in the plan above.

The idea of "Ie" continued to affect housing design. Just as guests held the highest social rank in the house,⁴⁴ the entry and reception room, which are intended for guests, were the most important spaces in the house.

2.312 Post-war Changes

At the end of the WWII, Japanese women obtained an equal legal standing with men. The establishment of the legal principle of sexual equality laid the foundation for judicial and educational reform.⁴⁵ At the same time, however, the strong conservative elements of society still expected women to conform to traditional feminine roles. Shunning individualism, traditional morality taught that "the husband leads and the wife obeys" and "man and wife are one flesh". The most significant post-war changes were:⁴⁶

1. Women becoming aware of their own situation.

2. An increase in men's understanding of women.
3. A higher level of education for women.
4. A rapid decline of feudalistic customs.
5. A stabilization of the economic status of most households.

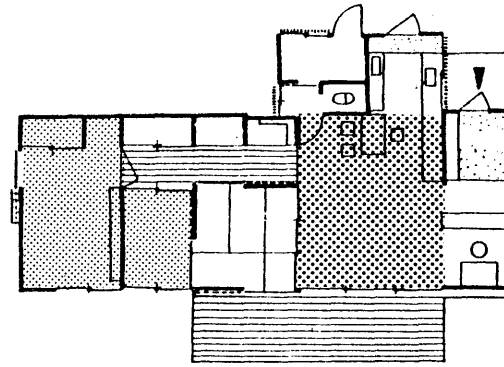
2.313 Rural vs. Urban

The difference in conditions between rural people, who are bound to the land and blood ties, and urban people, who are connected to one another through the arena of modern industry, must also be taken into account. This difference between urban and rural families has significantly affected the role of the wife. In rural areas, formerly a woman's role was to do "double duty", i.e., both housework and farming. Recently an increasing number of women are performing "triple duty": housework, farming and additional employment.⁴⁷

In the city, the wife plays an important role in the management of the household finances, controlling virtually all economic decisions. She has a smaller role as the earner of income.⁴⁸

Three significant recent trends in women's attitudes may be easily observed in urban areas:⁴⁹ an awakening to the need for self-improvement; the finding of freedom and pleasure in the home; and the establishment of equality between husband and wife. Equality has been reinforced by the recent custom of spouses addressing each other directly by their first name.

Women's growing desire to learn something other than housekeeping denotes their awakening to the necessity of self-improvement, regardless of how little time is left for her after household chores and childcare have been attended to. Japanese women continue to regard housework and child-bearing as worthwhile.



Legend:  Common space
 Private space

The intermediate and modern house reflects these social changes as cited above. Providing space for communal activities are characteristics of new house types. Spaces are no longer ranked by status, but are divided into two main categories: the public space, such as living room and dining room (for family activities and congrega-

tion), and private space, e.g., bedrooms. In addition to these two types there is the Tatami room, which is an independent multi-purpose room.⁵⁰

Private rooms are enclosed by fixed walls. This has been made possible by new technologies, such as dry wall construction and panel wall systems. As a result, sleeping arrangements have changed significantly. The place where husband and wife sleep, (both today and past), naturally affects the degree of intimacy in their relationship.

In the traditional house, there was no formal term for the bedroom. Furthermore, one could hardly detect where the family slept or ate. These spaces were kept neutral and less personal, by removing the furniture, e.g., a table, Zabuton (cushions), and the Futon (sleeping mat and comfort). For example, there is no such thing as a commercially available double-sized Futon. A single-sized Futon was used

and was always removed in the morning. Recently, this pattern has changed. A bed is often used in a young couple's bedroom. Other changes include the use of a living room and (western style) dining room sets. These furnishings indicate where the family sleeps, eats, and entertains its guests. Even the most personal space, the bedroom, is now easily recognizable. This demonstrates a new casualness, which is in sharp contrast to the rigid attitude of the past. The irony of traditional Japanese architecture is that the attitude toward the bedroom was closed, while the room itself was quite open. The irony of modern Japanese design is that attitude towards the bedroom is open while the walls securely enclose it.

2.314 Housewifery

Housewifery art, such as the art of flower arrangement and the tea ceremony, have added dignity to the Japanese wife's role.⁵¹ Originally, housewifery arts, flower arrangement, and the tea ceremony (all of which owe their elegance to Japanese philosophy and art) were practiced only by upper class wives. Today, these same arts are practiced frequently by middle class wives as well. Those who have learned the art of flower arrangement, arrange their meals with an eye towards beauty and aesthetics; and those who have learned the elegance and care taught in the traditional tea ceremony serve meals with a similar grace. This lends a touch of dignity to the housewife's role which is rarely found, for example, in the United States.

The housewife's aspirations are met by perfecting the housewife's role, not by escaping it. The Japanese wife is optimistic that she can expect somewhat greater self-fulfillment within her role as a housewife.



Tea ceremony

2.315 Danchi Life and Child-care

The new generation of white collar workers live in Danchi (public housing by J.H.C.). Their life-style has become an ideal for many Japanese, because, among other things, the wife of the white collar worker is independent of the mother-in-law. This new-found freedom has become a model for other Japanese women as well.⁵²

The way of life in Danchi is only one index of social change and the role of the nuclear family within the value structure of Japanese society. Today, isolation from social activities, child-rearing, "my-home-ism", and the leisure boom are typical characteristics of Danchi life.⁵³

Isolation from Social Activities and Child-rearing

Generally, wives of workers from the same company socialize with each other. However, in the Danchi, the husbands rarely belong to the same company, and as a result, the wives rarely socialize together. Instead the wives' attention is directed towards the care of their children. Social critics often find fault with this, because, in their opinion, the mothers devote too much attention to the care of their children. This phenomenon is not restricted to Danchi, but also occurs in new communities.

The traditional role of the woman, devoting more of her time and attention to being a mother than to being a wife, has not changed significantly in modern times.

"My-home-ism"

The new family ideology, "my-home-ism", implies that the husband should regard his family as his primary interest and accordingly spend as much time as possible with his family. The structure of the modern Japanese family is based on a central core, composed of the mother and children. Attached to this core is the husband/father. This modern life-style strongly affects housing design. Thus the recent focus of recent housing designs is the living room, while the barrier between the kitchen and the dining room has been removed. Currently, the kitchen, the dining room, and the living room are combined into one space. Designers pay most attention to the design of this part of the house.

Post-occupancy evaluations of Kodan (public housing) show that the use of apartments is very much affected by child-rearing practices. Parents evidently give higher priority to providing a private room for their children than having one for themselves.⁵⁴

1. Parents would move into the living room when either the number of children increased or when the children reached the age of six. Thus, the living room becomes a multi-purpose room (i.e., doubling as parent's bedroom and family living room).
2. When the parents move into the living room, the living room furniture is moved into the dining room.

2.316 Women in Japan vs. the United States

The major difference between Japanese women and middle-class American women is that Japanese women are more intent on enjoying and managing their domestic activities in order to obtain a better and fuller life within the home. In contrast, American women are more concerned with social activities and thus, they are generally more extroverted.⁵⁵ However, this difference is being slowly erased as Japanese life-styles as well as they become more westernized.

The introduction of Western culture has had a very strong influence on Japanese society. However, traditional values are also deeply embedded in the Japanese culture, and coexist with old cultural/social patterns, to result in a new synthesis, which incorporates elements of both, without losing its peculiarly "Japanese" flavor.

2.32 Correlevant Changes of Housing Design

"Housing designs are directly related to forms of social organizations, including the most important, the family." (Zina Green)

Housing changes in response to changes in the family. Over the past century, and until the period immediately after WWII, Japanese houses remained faithful to traditional characteristics, despite a century of ever-increasing foreign influence. However, a pronounced turning point in the evolution of the Japanese house came after the return of prosperity in the 1950's. The patriarchal family system had resisted outside pressure until the coming of democratization. Since the promulgation of Japan's new constitution in 1947, the Japanese system of family life has changed; and this change, combined with new housing technology, has radically altered the Japanese house.

Spaces characterized as neutral in the traditional house have been changing to family-oriented spaces and taking on specific use functions. These changes reflect changing roles and the status of women in the family and their life styles.

For example, within Japanese housing,

the arrangement and function of the kitchen, the place to eat, and the place to entertain guests have changed over time.

Table (analysis done based on "Collective Houses" (Shugo jutaku) by Suzuki Naribumi, demonstrates these changes).

Table 7.

| Year | Functional arrangement | Characteristics |
|---------------------------------|------------------------|---|
| Before 1950 | K C Z | Woman's place to work was completely segregated from the rest of activities. Zashiki was a core of house. Male dominated. |
| Mid. 1950's to beginning 1960's | K D L | Reception room became less formal and incorporates family meals. |
| 1960's | K D L | Kitchen became a more intergal part of the house. |
| End of 1960's to mid. 1970's -- | K D L | Kitchen, dining, and living room are the center of the house. Family oriented. |

Note K: Kitchen C: Chanoma(family room) D: Dining room
L: Living room Z: Zashiki(reception room)

Traditional House

Both the family and the idea of "Ie" are manifested clearly in the traditional house. Traditionally, family members were viewed as part of a collective identity Ie, which represents a single unit within a patriarchal system. This cultural attitude was reflected in the traditional arrangement of rooms which were differentiated according to the relative position of the family members. Naturally, the head of the house, the husband, received the place of highest priority.

In the West, the "mother" represents the family rather than the "father", and the expression of the interior reflects this influence. Many principles of residential design are derived from the esteem of the woman's place in the house. In comparison with the Western house, the Japanese residence manifests its male orientation through its form and function and a clearly displayed lack of reflection of women's presence.

In Japan, the head of the house represents the entire family and Japanese women identify themselves with their husbands. Spaces in the traditional house do not identify individual members. Rather, the arrangement of space reflects the husband's interests and activities. His place is clearly separated from other domestic affairs by the organization of spaces, the system of circulation and the arrangement of ancillary functions.

Modern

The Japanese family is no longer a patriarchy. The status and role of the wife have increased dramatically in the recent years and the wife, husband and children receive equal status within the family unit. Industrialization influenced the life-style of the household and husband more and more as the house was located further away from his place of work. Today, there is a variety of entertainment places available for business deals and for relaxation among friends; the husband, colleagues, and associates are seldom entertained in the house anymore. In general, compared with pre-1950's housing, the spaces in the modern house have become more family oriented and more personalized; one observes an increasing clarity in the definition of spaces due to increased use of Western style furniture.

Male Domain: Genkan and Zashiki

Traditionally, guests with high status were entertained at home. This characteristic influenced the place where guests were received and entertained by the head of the family. Genkan (entry) and Zashiki (reception room) were very important places where the head of the family's activities took place.

Traditional

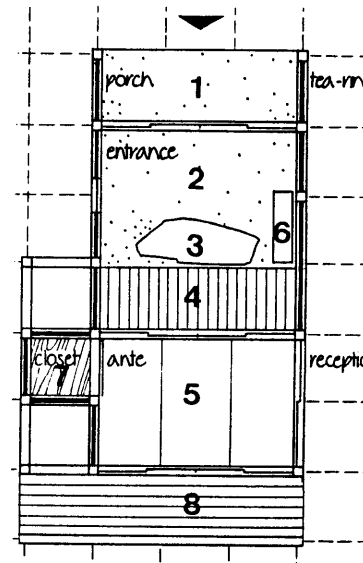
Genkan: Entry
 Very formal place in the house.

Location: Either side of the house.

Size: Max. 4,500mm x 2,700mm
 Min. 2,700mm x 1,800mm

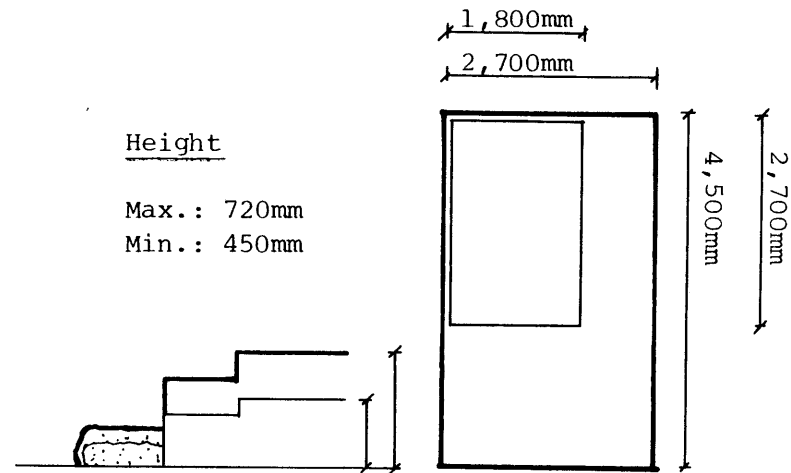
- Elements:
1. Approach level
 2. Step, on which shoes are removed.
 3. Shikidai, landing level
 4. Shoe shelf

- Function: Entry to all family members, except employees.
- Entrance hall: identification, greeting, and receiving visitors; chat with short-term visitors.
 - Receiving area: intermediate transition space to reception room.



Legend

- 1: Porch
- 2: Entrance hall
- 3: Step
- 4: Shikidai
- 5: Entry room
- 6: Shelf for shoes
- 7: Closet
- 8: Circulation



Modern

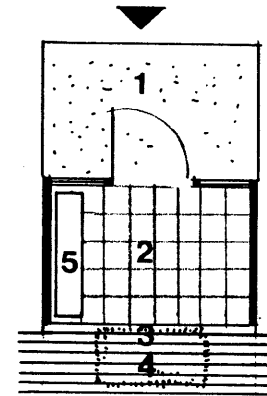
Genkan: Entry

Location: Access location from street.

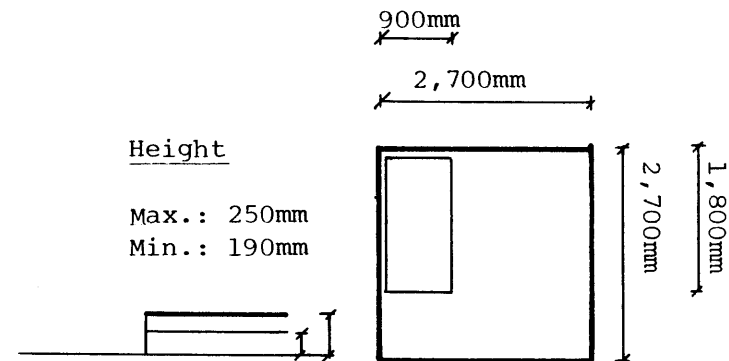
Size: Max. 2,700mm x 2,700mm
 Min. 1,800mm x 900mm

Elements: 1. Approach level
 2. Landing level (floor level)
 3. Shoe shelf, a small rug,
 and slippers.

Function: Entry to all family members.
 - Identification, less formal
 and short greeting, and
 reception of visitors.
 - Part of internal circulation.

Legend

1. Porch
2. Entrance hall
3. Landing
4. A rug
5. Shelf for shoes



Traditional

Zashiki (seat spread, Osetsuma (responding and meeting place), and Kyakuma (guest room): reception room

This room was the symbolic core of the entire house where the head of the family performs official functions and ceremonies while receiving guests.

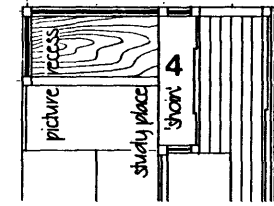
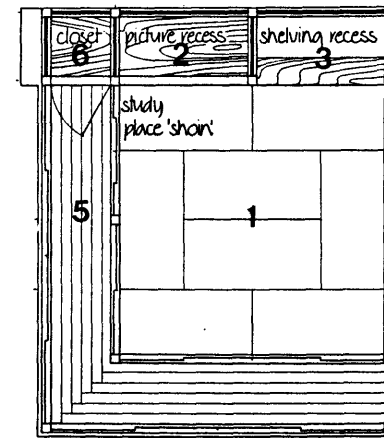
Location: Close to the entry or end of the house facing the garden; separated from the rest of activities.

Size: Max. 10 mats (4,500mmx3,600mm)
Min. 4.5 mats (3,600mmx3,600mm)

Elements:

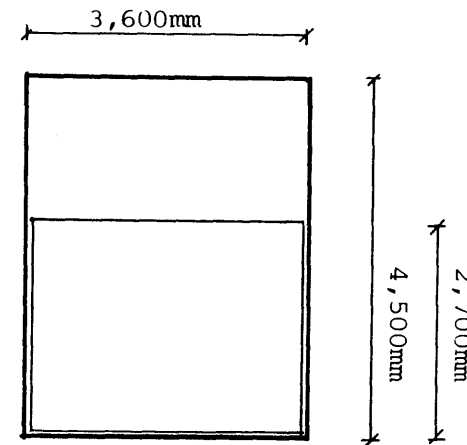
- Tokomona with chigaidana and shoin.
- Floor arrangement, a scroll
- Painting, and ornament on the Tokonoma.
- Osetusudai (a table) and Zabuton (cushion)

Function: Performance of official functions, ceremonies, bedroom for overnight guests.



Legend

- 1: Reception area
- 2: Tokonoma
- 3: Shelving recess
- 4: Shoin
- 5: Engawa (veranda)
- 6: Closet



Modern

IMA: Living room

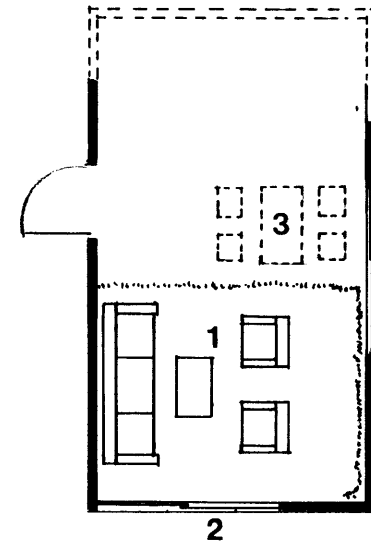
Family oriented, presence of women is easily detected by the atmosphere and colors, such as curtains, tablecloth, and cushion.

Location: Center or end of the house.

Size: Max. 12 mats (5,400mmx3,600mm)
Min. 6 mats (2,700mmx3,600mm)

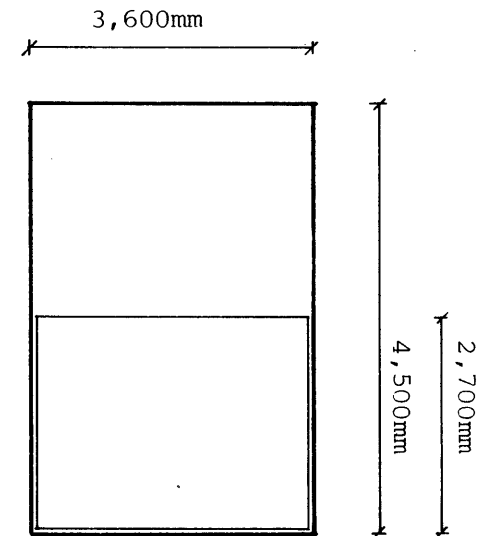
Elements: - Western furniture, chairs, sofa, and table, etc.

Function: - Entertainment of guests, but less used for ceremonial purposes.
- Family congregation and chatting.



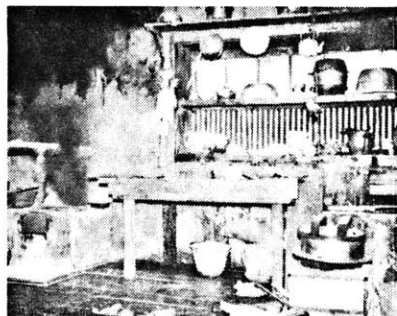
Legend

1. Living room
2. Terrace
3. Dining area



Woman's place: Daidokoro (kitchen) and
Chanoma (family dining room)

The result of lower status for women affected not only human relationships within the family and society but also the Japanese residence, especially the Daidokoro (kitchen) and Chanoma (family dining room) where women worked.



Kitchen (Traditional)

Daidokoro: Kitchen

Woman's status and the role she plays in the family was reflected by architectural neglect. The kitchen was nothing more than a simple place in which she worked all day long, cooking and cleaning for the family.

"As in ancient Western architecture, the kitchen stove is considered an important object and a symbol of prosperity of the house." (Engel)

Despite the notion that the kitchen was dignified by the presence of the stove with allusions to kitchen deities and the offering of foods to the fire god, these attitudes did not make the kitchen either a better or a more dignified environment, nor did they improve its cleanliness or lack of illumination.

In rural areas, the kitchen was used as a space for all kinds of indoor work while in the cities, more convenient types of kitchens with improved hygienic considerations and desirable variations in size and shape evolved.

Traditional

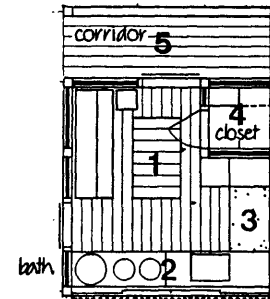
Daidokoro: Kitchen

Location: North side of the house; dark and no protection from cold drafts in winter.

Size: Max. 4.5 mats
(2,700mm x 2,700mm)
Min. 3 mats
(1,800mm x 2,700mm)

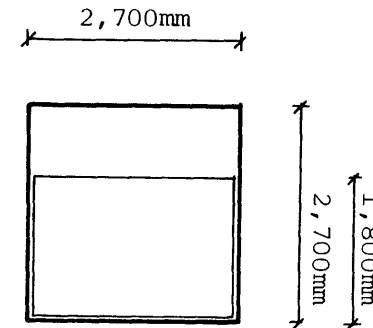
Elements: -A sink with cold water supply
-Kamado or gas range

Function: Preparation of meal, cooking, and washing dishes.



Legend

- 1: Working area
- 2: Kitchen counter (cooking area)
- 3: Back entry
- 4: Closet
- 5: Corridor



Modern

Daidokoro: Kitchen

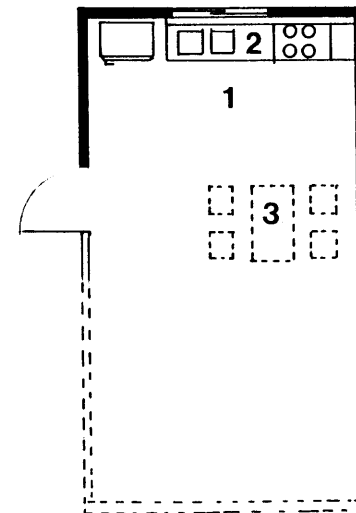
In recognition of the improved status of women, modern houses break the custom of placing the kitchen in an obscure location, a significant change from the traditional Japanese house. Now, Japanese women literally have a place in the sun instead of the dark cold kitchen of earlier days.

Location: Combined with dining and adjacent to the living room

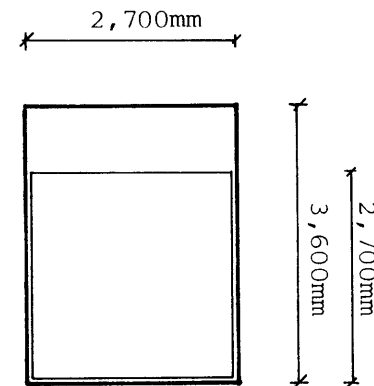
Size: Max. 6 mats
(3,600mm x 2,700mm)
Min. 4.5 mats
(2,700mm x 2,700mm)

Elements: Electric kitchen equipment, a refrigerator, an automatic rice boiler, a toaster, a micro-wave oven, hot water supply, etc.

Function: Preparation, cooking, washing dishes, and the place where the family and guests eat.

Legend

1. Working area
2. Kitchen counter
(Cooking area)
3. Dining area



Traditional

Chanoma (Room for tea): Family dining room

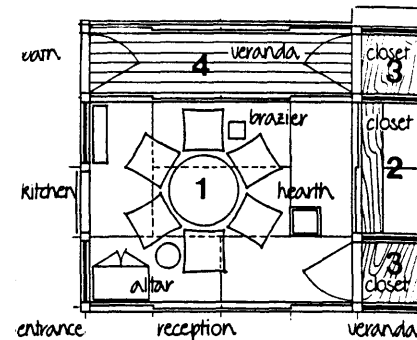
Despite the fact that the Chanoma was used for family activities and as a place where the housewife worked, its neutral characteristics were preserved like other rooms. As an indication of this neutrality, the low table and Zabuton (cushion) are removed after they are used. The Chanoma reflects this neutral space and the wife's image in the Japanese house.

Location: Adjacent to the kitchen

Size: Max. 6 mats (3,600mm x 2,700mm)
 Min. 4.5 mats (2,700mm x 2,700mm)

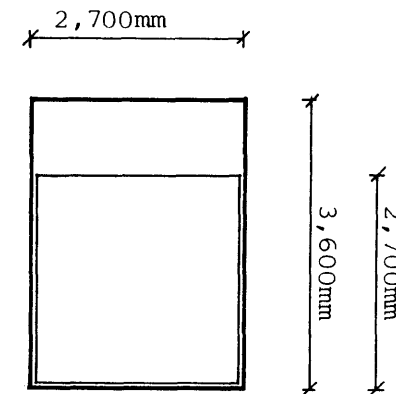
Elements: Chabuzai (low table) and Zabuton (cushions)

Function: - Family dining room where family eats and congregates.
 - Housewife performs domestic work and entertains her friends.



Legend

- 1. Gathering and eating area
- 2. Oshiire
- 3. Oshiire
- 4. Engawa (veranda)



Modern

Dining room:

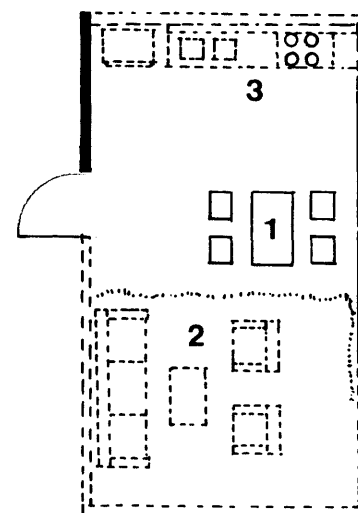
The Chanoma is replaced by a dining room where the family eats. The wife's domestic work and entertainment of her friends are transferred to living room.

Location: Located in the kitchen or in the living room.

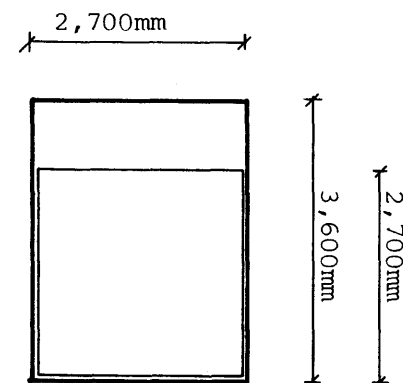
Size: Max. 6 mats (3,600mmx2,700mm)
Min. 4.5 mats (2,700mmx2,700mm)

Elements: Dining set (chairs and table)

Function: The place where family and guests eat.

Legend

1. Eating area
2. Living room
3. Kitchen area



Housing for Changing Roles

All these changes are ramifications of the combining and rationalizing of the housewife's function in the house, incorporating rather than isolating her activities from the rest of the family's activities, and enhancing her presence in the house. Such assertive changes may be observed in recent housing. The wife is participating in the design of the house by additions to work spaces of her own and by the inclusion of larger closets. Her taste and ideas about how the house should be arranged for the family are a stronger influence in current housing design.

Future planning for housing must reflect a different life style for Japanese women since their role is no longer confined to domestic work. Better education, the increase in work opportunities outside the home, higher income, the increasing acceptance of a woman's right to exercise alternative life-style options in life and rising aspira-

tions for a more independent life-style are all important influences on the role and status of modern Japanese women. The change in family size -- fewer children, and a wider spacing of births here affected the size and arrangement of the modern house. Both the increase in professional women in the work force, and the increase in white collar men bringing their office work home, have created the need for domestic work spaces for both the husband and the wife. New forms of housing, which reflect the dual roles of husband and wife have thus become necessary. More options in terms of alternative housing types and densities are required. Housing should permit a full range of life-styles including communal life-styles to allow, for example, three generations of women and men to share mutually supportive roles in child care and home making.

NOTES

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9. Kanto Shigemori, "Tsuboniwa no rekishi," Tsubo nowa (Tokyo: Mainichi shinbun sha, 1976), p. 172.
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11. Ibid., p. 117-179.
12. Kohei Hata, "Kage no niwa," Tsubo niwa, p. 172.
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15. Time, 1966, 39.
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31. Kenzo Ogata, "Genkan no sakutei," Genkan no niwa (Tokyo: Mainichi shin bun sha, 1977), p. 173.
32. Ibid., p. 168, 174.
33. Joyce Lebra, Joy Paulson, Elizabeth Powers, Women in Changing Japan (Boulder Colorado: West view, 1976), P. 1.
34. Ibid., p. 1-21; Engel, The Japanese House, p. 223.
35. Ibid., p. 224.
36. Labra, et al., p. 7.
37. Ibid., p. 7.
38. Suzuki, "Gendai no nihon jutaku," Ie, p. 187.
39. Ibid., p. 192.
40. Lebra, et al., p. 18.
41. Suzuki, "Gendai no nihon jutaku," Ie, p. 192.
42. Engel, p. 227-228.
43. Ibid., p. 222; Lebra, et al., p. 13; Takashi Koyama, The Changing Social Position of Woman in Japan (NY: The United Nations, 1961), p. 14.
44. Suzuki, "Gendai no nihon jutaku," Ie, p. 192.
45. Lebra, et al., p. 20.
46. Ibid., p. 301-303; James W. White, et al., Social Change and Community Politics in Urban Japan (Chapel Hill: University of North Carolina, 1976), p. 22.
47. Koyama, p. 60.
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49. Ibid., p. 66-69.
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3 CONSEQUENCES

- 3.1 Performance Statement Alternatives
- 3.2 Physical Changes

3.1 Performance Statement Alternatives

Performance statement alternatives are concerned with privacy, life cycle, family living standards, family composition, changing roles and furniture use changes as developed in Chapter 1 and Chapter 2. These alternatives provide options for the modern life-style which the traditional house did not.

PRIVACY

- o Provide optimum privacy for each family member.
- o Provide private room for each family member.
- o Control access(entry) to individual's room.
- o Provide storage space(closet, alcove, and oshiire) in each room.
- o Provide a storage space for furniture for family use, to increase autonomy of each room.

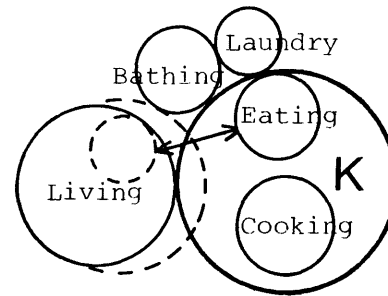
FAMILY LIVING STANDARD

o To insure each family member's private room, the living room as a center of life should be emphasized for all family members.

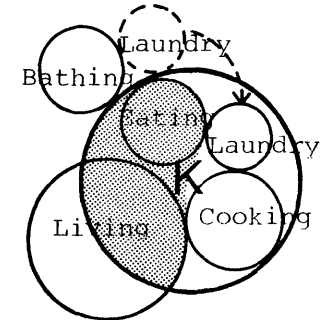
o Living room should be located adjacent to the dining room and kitchen; it should be south facing with sufficient space allowed for all activities.

o Living room should have visual accessibility and control of domestic area, i.e., kitchen and dining.

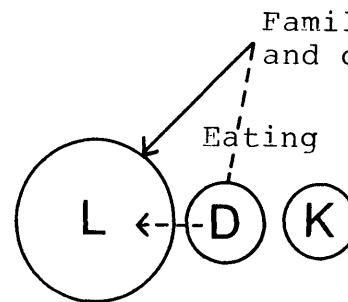
o Dining should be located on south side, and needs enough space to accommodate such living room furniture as the T.V. and a few lounge chairs, etc.



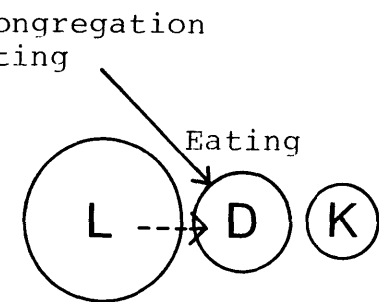
Existing



Alternative



Existing

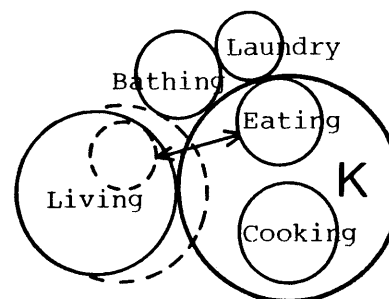


Alternative

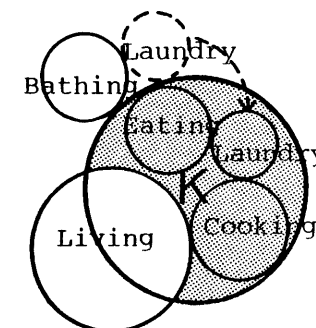
Family congregation and chatting

THE WORKING FAMILY AND CHANGING ROLES

- o Kitchen must have enough working space for at least two people to enable use by both husband and wife and other family members.
- o Other service space (e.g., laundry closet and ironing space) should be near the kitchen area and be accessible by all family members.
- o Space for electric kitchen equipment and food storage should be provided.
- o Individual work space for a professional couple should be provided.



Existing



Alternative

FAMILY COMPOSITION

- o Space sizes should be accommodate the minimum requirements for each life stage.
- o Change of use should be allowed, except in service areas.
- o Rooms for children under 6 years old and elderly parents should be located on the ground floor level or first floor.

LIFE CYCLE

- o Allow change of space required at each life stage. Table 8 shows the required range of flexibility from minimum to maximum.

Both tatami and Western style rooms persist in plans of Japanese housing. Taking into account the multi-functional characteristics of traditional Japanese house use, the variation of use patterns may be represented by using a morphological box regardless of the type of room (e.g., tatami room or Western style room). Table 9 presents the range of options and space use changes by life stages.

Table 8.

| | | |
|-------------|----------------|-------------------|
| | | K D L B1 B2 B3 B4 |
| K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| | | K D L B1 B2 B3 B4 |
| K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| | | K D L B1 B2 B3 B4 |
| K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |

Table 9.

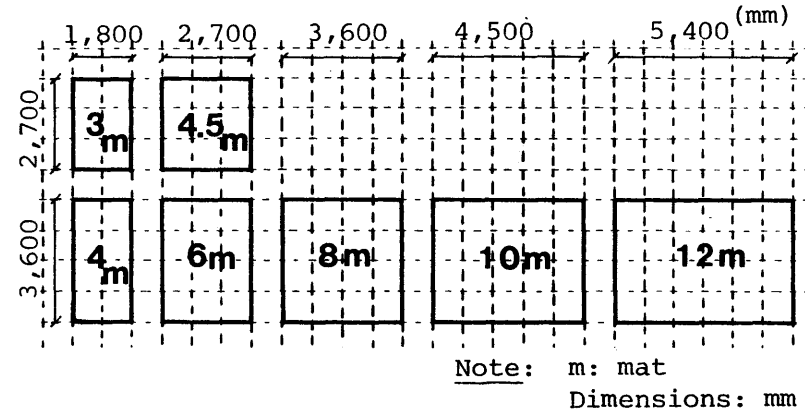
| Combination of K, D, L | | B1 | B2 | B3 | B4 |
|------------------------|------------------------|----------|-------------|----------------|-------------------|
| K D L | Multi-function L and B | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| | Separated bed room | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| K D L | Multi-function L and B | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| | Separated bed room | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| K D L | Multi-function L and B | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| | Separated bed room | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| K D L | Multi-function L and B | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |
| | Separated bed room | K D L B1 | K D L B1 B2 | K D L B1 B2 B3 | K D L B1 B2 B3 B4 |

*Note: K: Kitchen D: Dining(eating) L: Living room B: Bed room(sleeping)

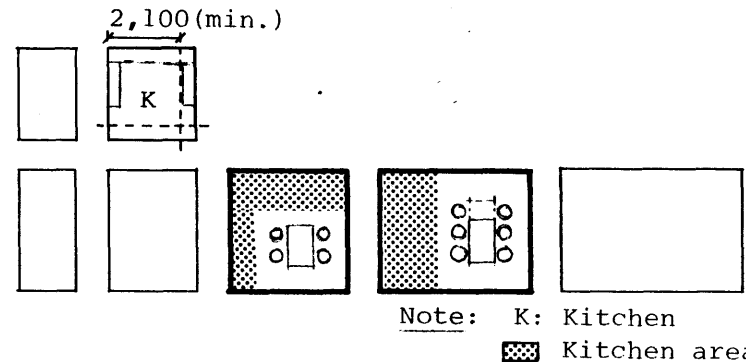
FURNITURE USE CHANGE

- o Tatami rooms should be 6 or 4.5 mats in size, to avoid multiple person sleeping.
- o Where Western furniture is used, 8 to 12 mat rooms should be provided for two persons, while 4.5 to 6 mat rooms should be provided for one person.
- o DK (dining and kitchen) room, should be 8 to 10 mats in size to allow for dining table, chairs and cooking equipment, storage area and some living room furniture (e.g., T.V.).
- o Living room should have a minimum of 10 to 12 mats to provide enough space for Western style furniture.

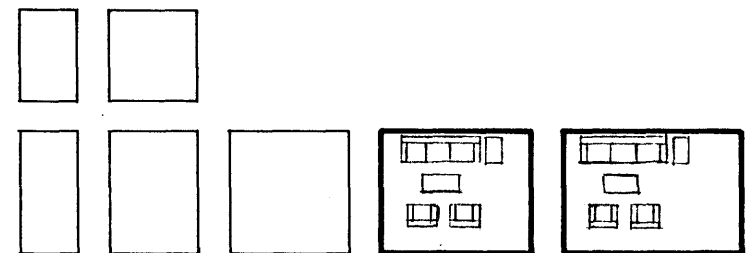
Typical Japanese Room Dimensions



Kitchen and Dining

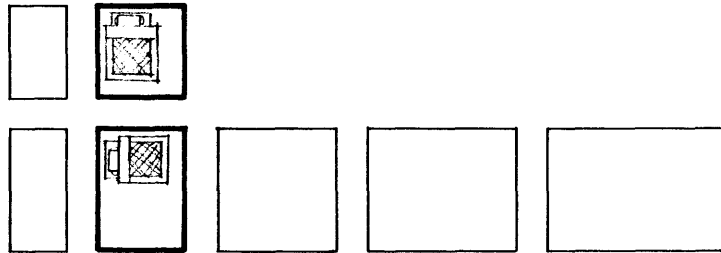


Living room



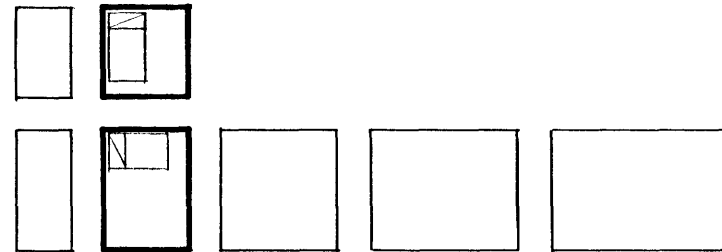
Bed room

A room for one with Futon

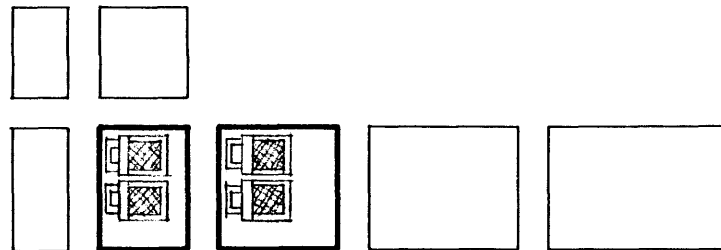


Bed room

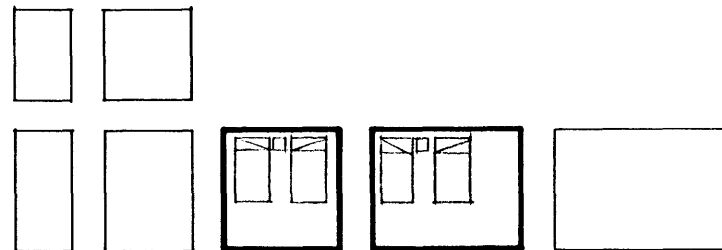
A room for one with a bed



A room for two with Futon



A room for two with beds



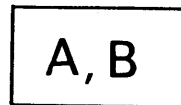
3.2 Physical Changes

Physical changes in the house can be used to allow new performance statement alternatives. The performance statement alternatives "privacy", "life cycle", and "family living standard" have been examined in the following charts. Changes in use in combination with physical changes will allow flexibility to adapt to the requirements of different stages of the life cycle.

Short term and long term solutions are defined as follows:

Short term

1. Doubling up the space by multi-functional use.



Long term

1. Doubling up the space by multi-functional use.
2. Increase and decrease the size of space.
3. Add another space.
4. Combination of 2 and 3.
5. Change usage.
6. Occupy by others..

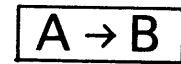
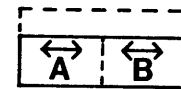
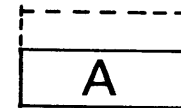
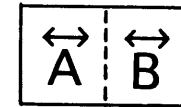
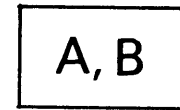
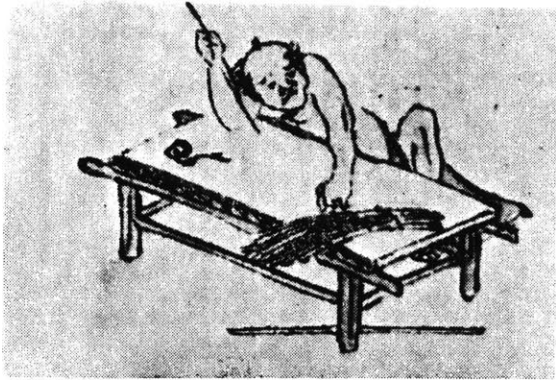


Chart 9.

| Performance statement alternatives | | Physical changes | | | | | | Resulting use of elements | | | | | | |
|------------------------------------|------------------------------------|------------------|-----------|-------------|-----------|-----------|-------|---------------------------|---|---|---|---|---|---|
| | | Location | | | | Elements | | 1 | 2 | 3 | 4 | 5 | 6 | |
| Privacy | Optimum privacy between two rooms. | same floor | Adj. | Acous-tical | | Wall | Stru. | ● | ● | | ● | | ● | ● |
| | | | | | | Non stru. | ● | ● | ● | ● | ● | ● | | |
| | | | | Partition | | | ● | ● | ● | ● | ● | | | |
| | | | | Visual | ● | Wall | Stru. | ● | ● | ● | | ● | ● | |
| | | | | | | Non stru. | ● | ● | ● | ● | ● | ● | | |
| | | | Partition | | ● | ● | ● | ● | ● | ● | | | | |
| | | | Non adj. | Acous-tical | ● | Wall | Stru. | ● | ● | | ● | | ● | ● |
| | | | | | | Non stru. | ● | ● | ● | ● | ● | ● | | |
| | | | | Partition | | | ● | ● | ● | ● | ● | | | |
| | | | | Visual | ● | Wall | Stru. | ● | ● | | ● | | ● | ● |
| | Non stru. | ● | | | | ● | ● | ● | ● | ● | | | | |
| | Partition | | ● | ● | ● | ● | ● | ● | | | | | | |
| | Other floor | Both | ● | | | ● | | ● | ● | | | | | |
| | Control of access | same floor | Adj. | ● | Wall | Stru. | ● | ● | | ● | | ● | ● | |
| | | | | | Non stru. | ● | ● | ● | ● | ● | ● | | | |
| | | | | | Partition | | | ● | ● | ● | ● | ● | | |
| | | | Non adj. | ● | Wall | Stru. | ● | ● | | ● | | ● | ● | |
| | | Non stru. | | | ● | ● | ● | ● | ● | ● | | | | |
| | | Partition | | ● | ● | ● | ● | ● | ● | | | | | |
| | | Other floor | | ● | | | ● | | ● | ● | | | | |

Note: ● : Yes ● : Possible No Stru.: Structural
 Adj.: Adjacent



4 TECHNOLOGY

4.1 Technology of Housing after WWII

Definitions of Building Elements

In this thesis, the terms are used as defined by the EPA:

| | | | |
|-------------------|---|------------------|--|
| Materials: | Delivered from quarry or factory and having no definite geometric shape. | | and parts which serve a number of purposes. Can be independent of their final application to the building form (open components) or directly related to it (closed components), e.g., window; wall panels. |
| Section: | Material produced in semi-finished form, usually manufactured by a continuous process of definite cross-section and unspecified length. | | |
| Part: | The product of forming processes, and having defined mass which will eventually serve a specific function, either independent of later forms, e.g., screws, or as constituent parts of later forms, e.g., extruded window sections, or sheet materials. | Elements: | Combinations of different materials, parts and components, to cover a wide range of requirements which are related to one major locatable function in the building, e.g., preassembled walling. |
| Unit: | Material produced in finished form of specified dimensions, simple forms, and limited use. | System: | The simultaneous use of selected complex constituent parts of a building when a number of elements are inter-related for assembly on site. |
| Component: | Sub-assemblies of materials | Building: | Works resulting from the acts of construction. |

4.1 Technology of Housing After WWII in Brief

The development of technology for industrialization and mass production have had great influence on modern housing, affecting not only house form but also impacting primary and secondary components, treatment of the exterior and interior, mechanical systems, and the organization of interior space.

The development of industrialized housing after WWII can be divided into four stages.¹

The First Stage: 1951-1954 Development of new materials.

The Second Stage: 1955-1965 Development of prefabrication of housing and precast concrete (PC) apartments.

The Third Stage: 1965-1974 Development of parts and volumetric units.

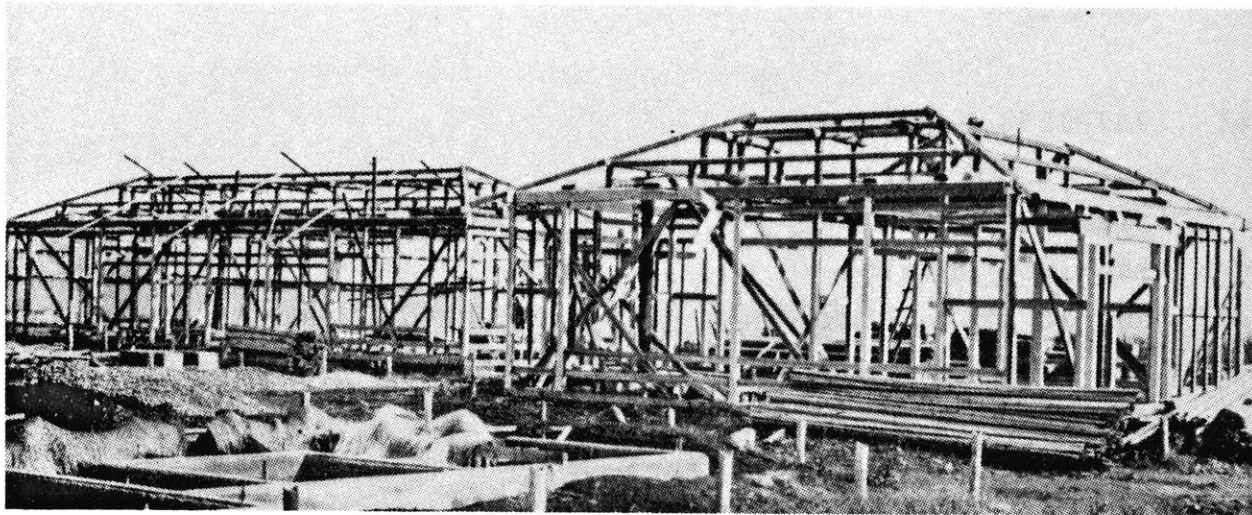
The Fourth Stage: 1975 to present. Development of kit of components and parts.

Post WWII: 1945-1950

The recovery period immediately after WWII from 1945 to 1950 sets the context for these four stages of development.

In 1945, the Japan housing shortage numbered 420,000 units. That year the government initiated various temporary measures to address this shortage. The industrialization of housing production coincided with the

Japanese concern for modernization and the creation of a new society. This included the development of a year round labor force from what had previously been seasonal traditional carpentry and the improvement of the working condition of construction labor in general; work traditionally done outside was now performed in a covered space.



Conventional Wooden Construction (election)

Initially, prefabrication technologies tried to make use of unused military facilities, such as wooden airplane factories. Certain aspects of industrialization, such as rationing of materials, were carefully supervised by the government, while research was done by architectural associations. However, many of the early products of the prefabricated housing industry were later demolished; they were extremely unpopular because they were too small, poorly designed, expensive, and because people could not afford them. Thus, prefabrication did not reach a high stage of development. One private initiative, "Puremosu" and "Crown (kuraun) C type" wooden prefabricated housing also failed, despite high standards of design, because the public was not ready to assimilate the new technology.

After this initial failure, development focussed on public housing, using reinforced concrete. The pri-

mary concern was for government-sponsored rental housing for laborers working in the basic industries, such as coal mining and steel.

The First Stage: Development of new materials
1951 to 1954

The driving force during the first stage was the desperate demand for new housing and materials after the Korean War and the need to revitalize industry. The full-scale recovery of industry began with the installation of new equipment after 1951.

In 1950, the government established the Finance Corporation (Jutaku kinyu koko), which not only loaned money to individuals for housing construction, but also guided the development of housing systems. This was the first attempt to loan money to individuals for housing construction. At the same time, local public housing authorities (Koei jutaku) were guiding

the development of housing and experimenting with new construction methods. A main concern at this time was the use of non-combustible materials; concrete block housing received a lot of attention; simultaneously precast concrete (PC) construction methods were being developed.

During this stage, the industrialization of the conventional wooden house also began. The most important characteristics of this stage were the development of various panel materials: block, plywood, surface treated plywood, aluminum, light weight steel, FRP and glass. These were initially used for conventional wooden house construction and later adapted to light weight steel prefabricated housing. Carpenters and general contractors preferred the new materials because they offered the advantage of dry finishing and reduced the number of operations in the construction process. Traditional carpenters and gen-

eral contractors had no option but to become part of the material industrialization process. The catch-phrase was: "cheap and efficient mass production". This attitude led to the lowering of quality standards in speculative housing by using new but cheap materials. In the ensuing recovery period, the financial position of most people gradually stabilized, and the attraction of the idea of owning a traditional "real house" increased accordingly.

The Second Stage: Development of pre-fabricated housing and PC apartments
1955 to 1964

During 1955 - 1964, the standard of living improved but the housing shortage continued. Mass construction of housing was needed in the 1950's due to migration to the main city centers. The housing shortage became the major problem in the big cities.

Due to the lack of carpenters and skilled laborers after the war, pre-fabrication technology developed rapidly. Mass production increased enormously. The government set a "Ten Year Plan, aimed at providing 480,000 units of housing". However, the growth of public housing construction was slow, due to the lack of adequate financing. In 1955, the Japan Housing Corporation (J.H.C.) was established with the intention of channelling private capital into hous-

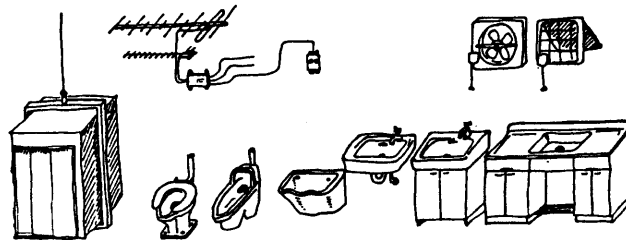
ing. Using the PC system, public housing was built both by the J.H.C. and general contractors.

J.H.C. used the technology which was developed by the local public housing authority (Koei jutaku). The J.H.C. contributed to the development of housing construction technology by experimenting with middle-size reinforced concrete (RC) for apartments and terrace houses. Methods using middle-sized and large PC tilt-up panels were also developed. Industries for PC production were built in most of the larger cities; these covered the surrounding area at a radius of 50 Km, and construction averaged two to three houses per day. The J.H.C. also modernized housing construction through the use of reinforced concrete. The private sector, which was strongly influenced by private demand, began to increase production as well.

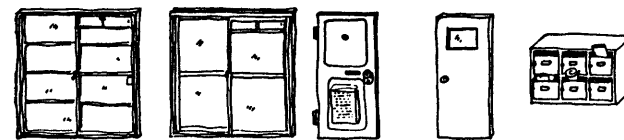
New construction materials were developed during this stage; this was facilitated by the increase in domestic production of light weight steel. In 1958 and 1959, steel-assembled housing was built by Hankyu Real Estate Co. Light-weight steel development of the "cold forming" mass production process, and the method of combining steel panels with various boards were developed. These originated with systems which were used for the Missetto House by Daiwa House Co. and the Sekisui House Co. At the same time, Eidai Sangyo Co. and Mat-

sushita Denko Co. started the development of prefabrication in housing. Also during this period, the development of parts, such as press processed aluminum frames, stainless sinks, steel doors, and KJ sub-systems, advanced rapidly. They became important factors in the third stage, which was dedicated to sub-system development during the housing industry boom.

Wooden prefabrication and wood panel production technology, which used glue-laminated panels, was also developed. Misawa Home Corporation specialized in this system and became



KJ parts



the leader in this field. Wooden rental apartments increased in number, and private condominiums also started to appear during this period.

Three types of prefabrication methods were developed which used concrete as building materials: the widely used PC method of Danchi, mass-produced middle-size panes, and concrete blocks. Concrete blocks, which were new to the market, were little by little accepted as a viable building material.

Panel systems tried to increase efficiency in three ways:

1. Lower cost through mass-production.
2. Save materials in structural members.
3. Reduce on-site construction processes.

This trend towards industrialized construction methods was strengthened when J.H.C. took over many activities that had previously been part of the

local public authorities.

Prefabricated housing was approached from a different starting point than conventional housing construction. Nevertheless, conventional housing improved as well, primarily as a result of using new industrialized parts, such as stainless steel sinks and various aluminum window and door frames.

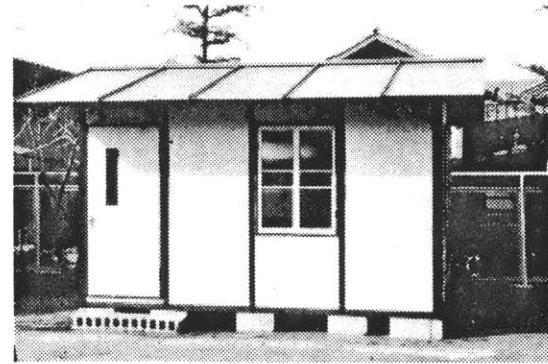
Industrialization from 1960 to 1964

During the early '60's, a prefabricated "shed" (too small and too poor to call a house) and a single prefabricated house which was marketed later, gained popularity. Materials manufacturers, electric utilities and real estate companies began to sell prefabricated housing on a large scale.

Banks started to provide housing loans and the Financial Corporation (kinyu koko) recommended the construction of "non-combustible assembled housing".

Although major growth did not occur until the late 1960's, the prefabricated share of the housing market grew during this period.

With the modernization of parts and components by the J.H.C. and Koei jutaku, the construction of large PC panels, which combined welded steel joints, thin middle-sized panels, and wooden interior panels, made possible the development of both mid-rise and low-rise mass-produced public housing. Each element was manufactured by several different companies. This was the beginning of an open component system. Aluminum frames for openings, kitchen sink sets, bath tubs, and lavatories became very popular. The interiors of conventional housing began to change as more and more modern and industrialized parts were introduced into general use. When fully prefabricated volumetric units began to be used in hotel construction, the next stage of industrialization, i.e., the Large



Mizetto House, 1959.
(Prefabricated house)

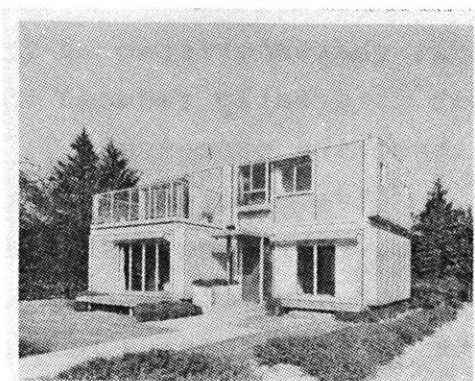
Unit Systems, was initiated.

In the mid 60's mass-production increased its share of housing, due to mass-marketing techniques, and new combinations of conventional structural systems. Prefabricated housing became fashionable as an image of modern living. The prefabrication industries were not only engaged in manufacturing; they also influenced apartment housing by introducing steel systems, which in turn led to the development of the town-house type. Foreign prefabrication enterprises also entered the market.

The Third Stage: Development of parts
and volumetric units
1966 to 1974

Development period from 1966 to 1969

The demand for prefabricated housing rapidly increased because of the continued migration to the cities after 1955. In 1966, "The First Five Year Plan for Construction" was passed by the Cabinet Council. It was aimed at improving living standards to a minimum of nine mats for a small family, and twelve mats for an average family. The plan was not successful,

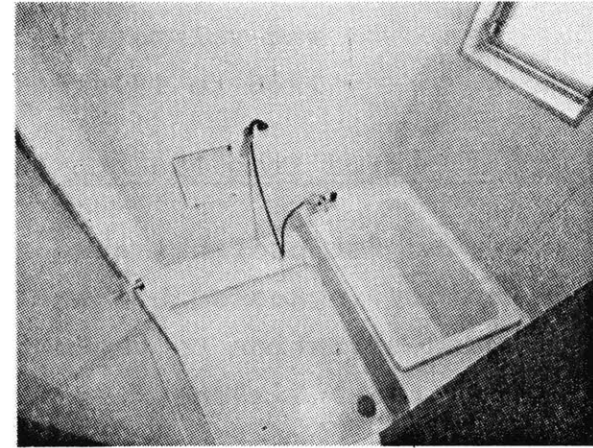
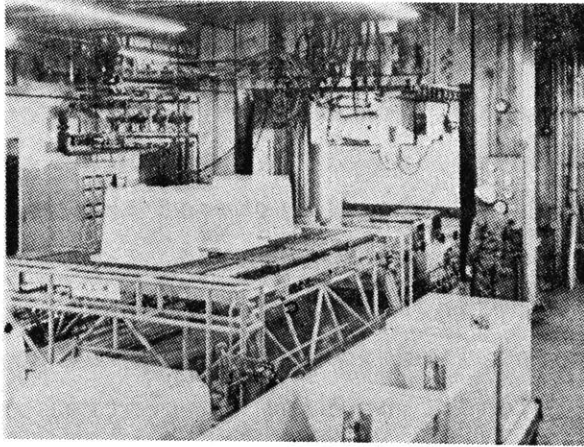


Volumetric Units House
Sekisui haimu, 1971.

because the standards proposed were too large for this period.

Due to random development, higher land costs, and other factors, prices soared and the quality of the residential environment deteriorated, leading to the lowering of regulatory standards. This resulted in a shortage of land suitable for housing in central cities, long commuting time to work, delay in the installation of public facilities, and high density construction which meant the loss of natural light due to close spacing of the units.

Sekisui Haimu and YNSU are the first examples of the use of large volumetric units. They entered the market around 1969. The Ministry of Construction helped to promote sales of prefabricated houses. However, prefabrication did not increase housing production more than 20% and was not able to meet user demands as anticipated.



Bathroom Unit

Parts of service functions, such as bathroom units and kitchenettes, were developed and introduced by the Kodan PC system housing. However, these prefabricated systems were not applicable to single-family housing, because of lack of standardization, lack of development of joint details, the high cost of building materials, and transportation costs.

"Volumetric Units" as offered by Sekisui Haimu, were a successful development of this period. They were intended to solve some of the above

mentioned limitations of prefabricated construction and lower the high costs of open system parts. The units were nearly 100% finished at the factory with little assembly necessary on the site. The first characteristic of the system was that it greatly reduced the number of construction processes. According to the Living Research Office, the total process, including installation and design for the volumetric units, consists of 48 stages; a panel prefabrication system has 72; and a conventional system requires 100 stages.

The second merit was the reduction of costs through mass production and direct acquisition from the manufacturer. However, the end result was that the size and shapes of various parts were not coordinated; problems in distribution and marketing further inhibited widespread use of this system. Nevertheless, the development of volumetric units, subsystem parts and the theoretical possibility of coordination and compatibility led to further research and technology which guided the next period, i.e., the development of coordinated parts.

Re-evaluation period from 1970 to 1974

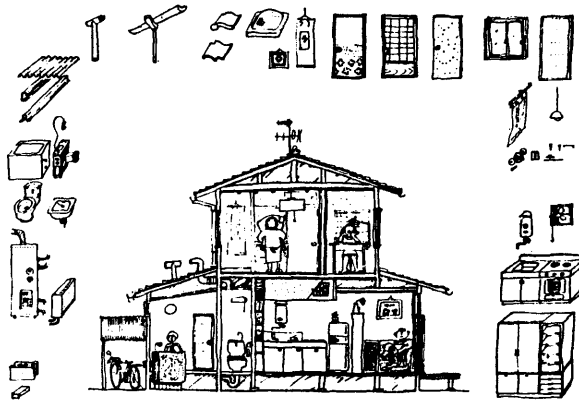
In 1970, a pilot housing design competition was initiated by the government to stimulate the development of housing technology. The government passed stricter legislation, which required better quality for more effi-

cient housing solutions. At the same time, the government created an educational system for engineers.

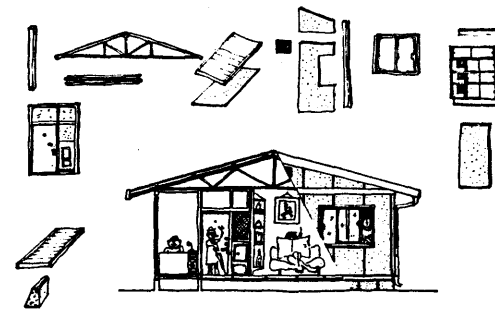
Companies produced individual components and parts rather than making a whole house. The research entitled "Parts for Housing Facilities and Standardization" was started by the Japan Architecture Center (Nihon Kenchiku Senta). In this research, the concept of an open system was experimentally developed. Such a system could be used for any type of housing. The parts of the house, such as bathroom units and kitchen units, were built separately but made compatible to match other parts. The above mentioned research led to the development of the "BL part rule (BL buhin seido)" and "KEP experiments" for Kodan by the Japan Architecture Center, the Japan Housing Facility System Association (Nihon Jutaku Setsubi Sisutemu Kyokai), and the Housing Parts Development Center (Jutaku buhin kaihatsu).

During this period large developers expanded their business to housing, housing loans became readily available, and the plan for the reconstruction of Japan Island (Nihon retto kaizo keikaku) by the minister Tanaka was initiated. In a high-rise housing competition of that period, the Ashiyahama ASTM system won the first prize. Large companies demonstrated their advantages over small

companies in the field of large and diverse projects. The oil crisis of 1973 caused the situation to change drastically, and the economy suffered a considerable decline in gross national product. A serious re-evaluation of the whole Japanese economy became necessary. Since the housing industry played an important role in socio-economic policy making, the re-evaluation of the housing industry

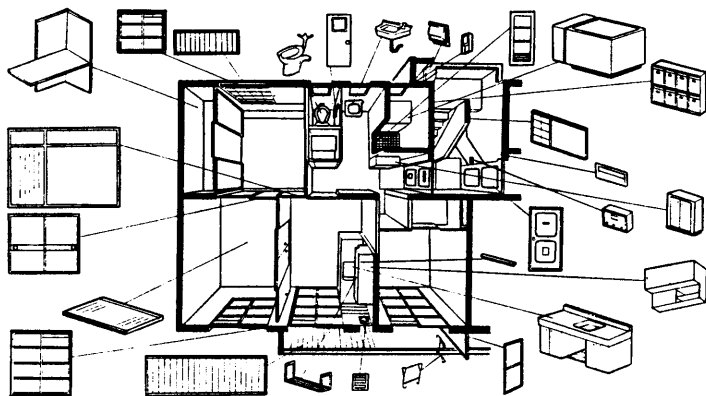


The parts for single detached house.



The parts for LGS(light weight steel) prefabricated house.

had to be undertaken as well. The oil crisis caused a shortage of various products. This forced the housing industry to change its policy to emphasize quality rather than quantity.

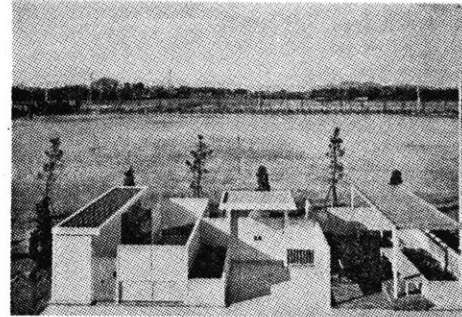
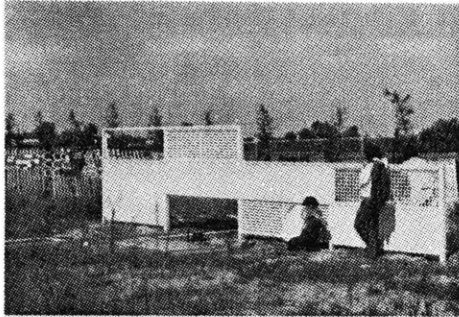


The parts for Kodan, public housing by Japan Housing Corp.

The Fourth Stage: Development of Kits of Components and Parts from 1975 until the present.

The open system of components and parts gradually became accepted in housing construction. Various systems had been developed from which the user was able to choose. These systems need to be evaluated on the basis of performance, rather than on the basis of their technological aspects alone and cost.

During this stage, the construction of public housing decreased, because of lack of suitable land and the high cost of materials. After the oil crisis, and during a housing competition called "House 55", closer attention was paid to energy-efficient housing. The variety of housing types gradually increased. Urban housing types became more widespread and a variety of types ranging from single



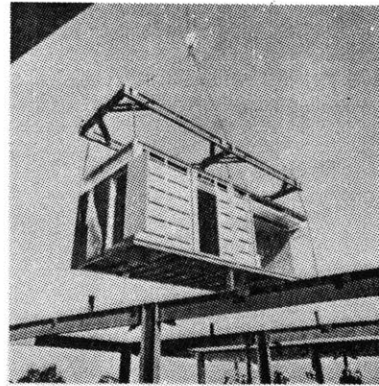
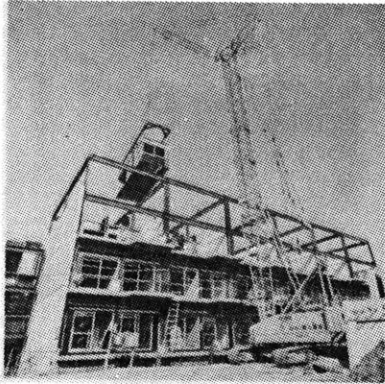
ECP system

family house to high-rise condominiums were built on single small lots.

Flexibility and variety by combination rather than technical innovation were required. The concept of kits of components and parts in housing was developed to meet these criteria. Housing could now be assembled from a catalog, in order to accommodate variety in demand. This is the real advantage of industrialization as opposed to the prefabrication of an entire house. Each manufacturer specializing in different components and parts is able to provide compatible products as kits on the open market.

The ECP system was developed for this purpose.

ECP System: This is a system which was developed for urban housing, and which is composed of sub-systems such as interior walls, exterior walls, storage units, pagodas, service yards, and many others. Its advantages are: efficient use of the site, freedom of design, and lower cost. This system provides kits on the open market. Each can be in-

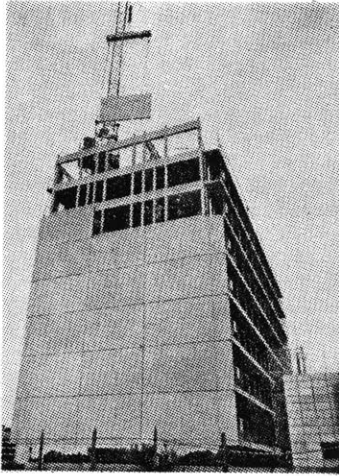


SK system

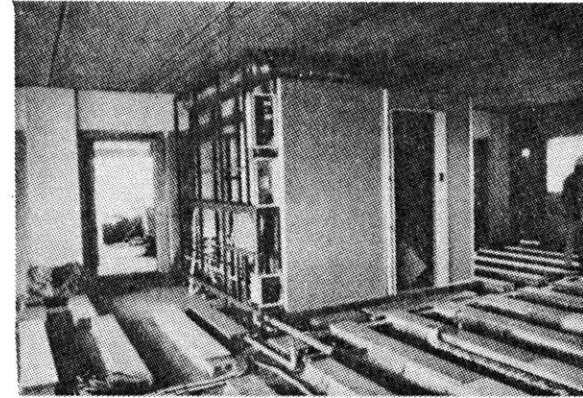
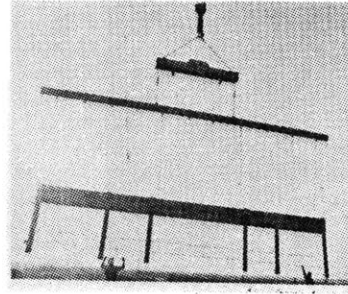
stalled by only one trade. Moreover, users can design the plan of the house according to their own taste, using a design manual. Furthermore, it is relatively easy to add to the parts of the system by request of the user.

Currently, the kits of components and parts is limited to special projects, such as the SK system, SAP system, KEP system, and ASTM system, which were each developed for a particular project.

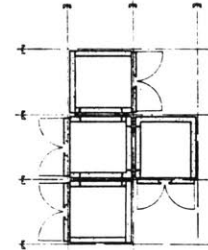
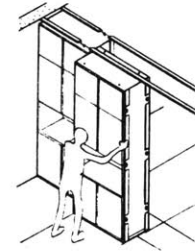
SK System: This system was developed through the association of volumetric unit makers, PC panel makers, and steel makers. Various designs were implemented by each of these three different systems.



SAP system



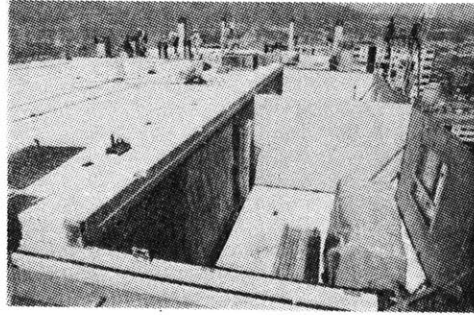
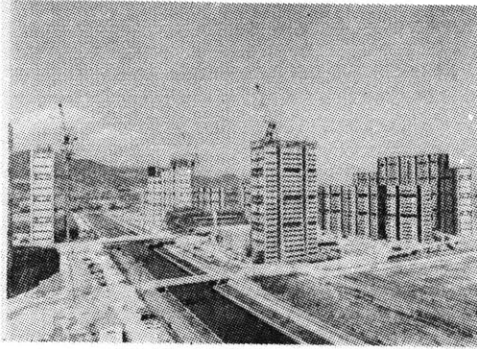
KEP system



SAP System: This system was developed especially for high-rise housing developments by another group of companies. New technology was effectively used, such as GRC wall panels and prefabricated vertical core units.

KEP System: The Japan Housing Corporation developed this system for public housing projects. Experiments

were repeated many times and the research for sub-system development was done by associations of different manufacturers, which were established under the authorization of the KJ and BL (Buhin ninteiseido). Expectations for the future development of this system are more optimistic than for other systems.

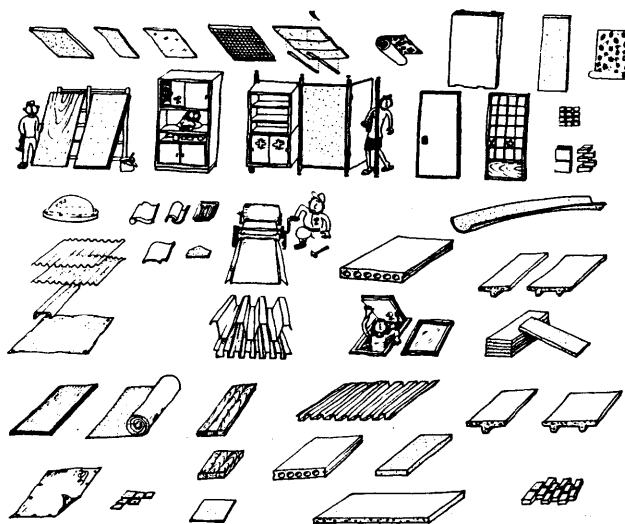


ASTM system

ASTM System: This system was developed for Ashiya hama high-rise public housing, which won the first prize of a housing competition in 1973.

The chart at left follows the development of different types of housing technology.

The development of parts, units including volumetric units, kits of components and parts, and other technological developments is shown as it relates to the development of public housing, prefabrication of housing using different materials, and the development of the closed component vs. the open component.



Existing open components and parts

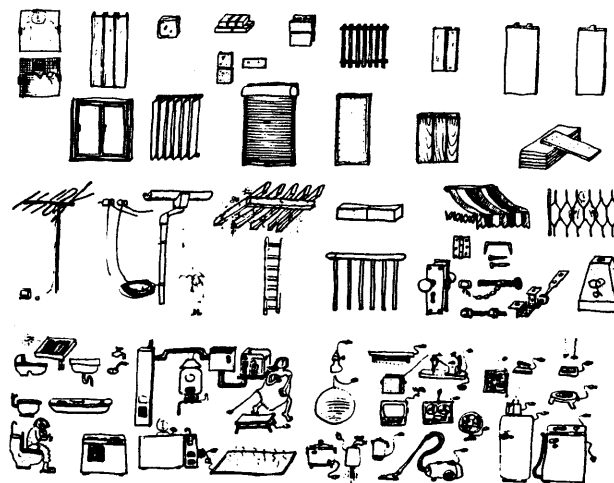
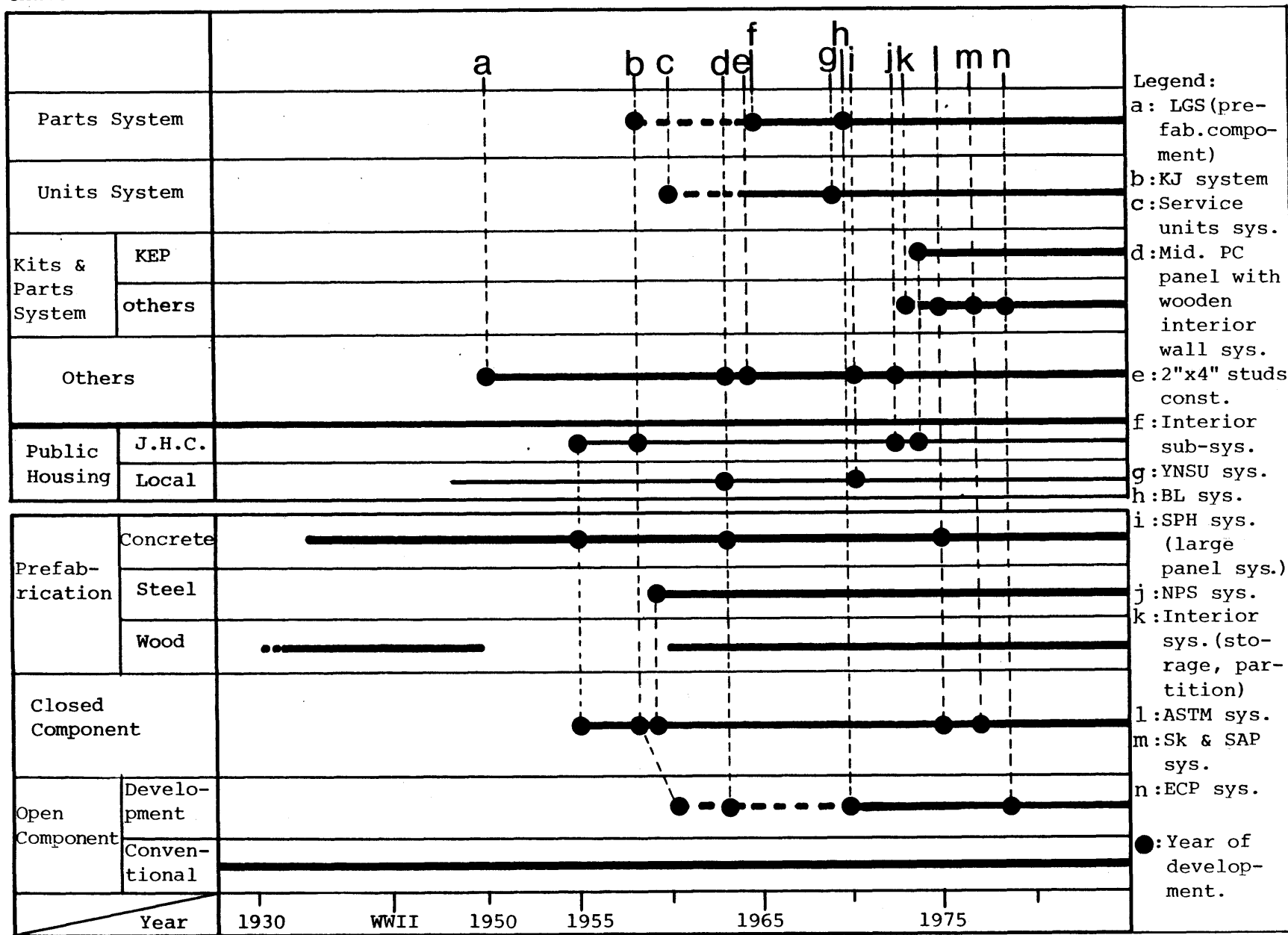


Chart 11.



NOTES

1. This chapter has been based on Katsuhiko ono, Toshigata jutaku (Tokyo: Kogyo chosakai, 1979), p. 126-150; GA 78, Feb. 1978, p. 11-23; Yoshichika Uchida, Kenchiku seisan no open sisutemu (Tokyo: Sokoku sha, 1975).

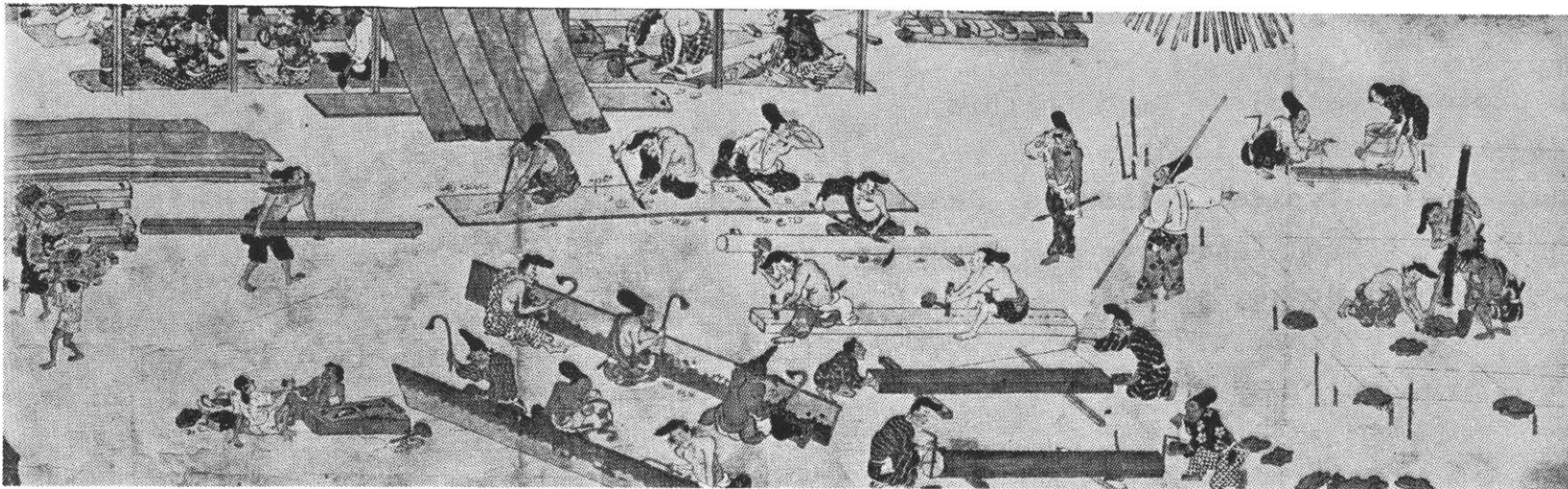
5 TRANSFORMATION

- 5.1 Transformation of Spacial Elements
- 5.2 Building System and Materials
- 5.3 Transformation Factors and Changes

5.1 Transformation of Special Elements

This chapter examines how technology and life-styles influence Japanese housing design in three architectural periods. The three periods under examination are the "Traditional," "Intermediate," and "Modern." The traditional house (which was built between 1868 to 1945) has a floor area of about 50m^2 . The intermediate period house (which was built between 1945 and the 1970's) has a

floor area ranging between 70m^2 to 75m^2 . The modern house (built since the end of 1970) has a floor area ranging from 80m^2 to 120m^2 .



In the following analysis special attention will be paid to physical characteristics, architectural features, and technological development, and how each of these affected the three stages of Japanese dwelling architecture. Each of these categories will be used to analyze a variety of rooms, common to each of the three stages of Japanese housing. The analysis will focus on the entry, the bathroom, the Senmensho (basin area), the lavatory, the kitchen/dining area, the living room, and Tatami mats.

The prototypical plans used in this analysis are the following:

Traditional: Typical residence, Heinrich Engel in The Japanese House (pg.87).
Floor area: 50m²

Intermediate: Sekisui House Corp. built 1960-1970.

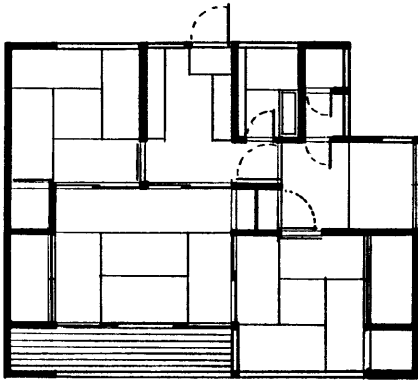
Floor area: 73m² (plan A&B)

Modern: Asahikasei House Corp. built 1975-1980.

Floor area: 77m² (plan A)

94m² (plan B)

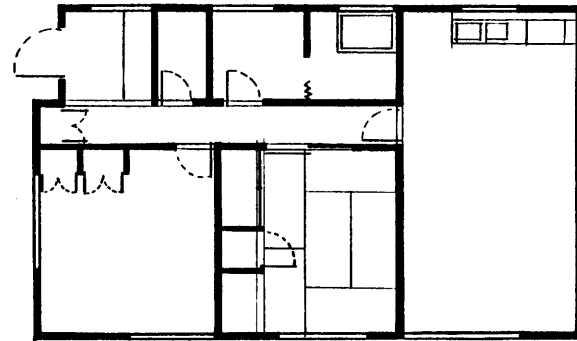
Traditional



Intermediate



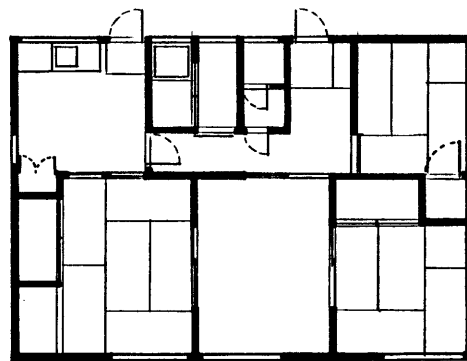
Modern



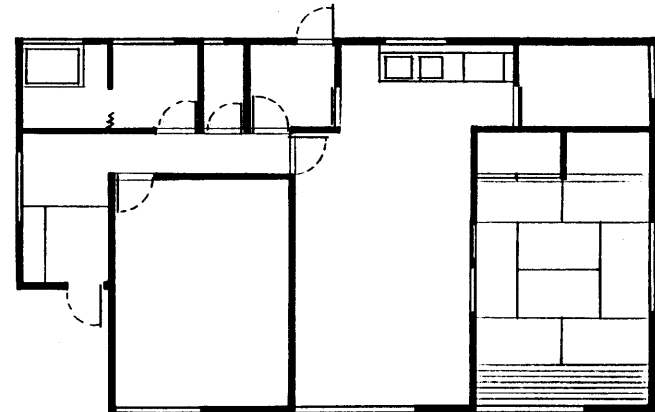
Prototype A

Prototype A

- FIXED WALL
- + SLIDING DOOR
- MOVABLE PARTITION



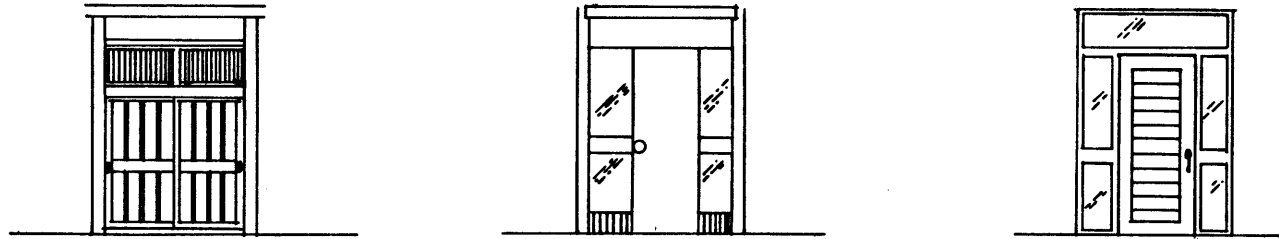
Prototype B

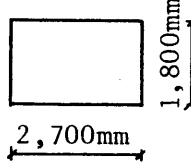
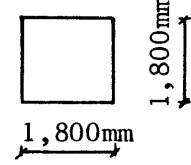
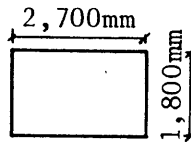


Prototype B

ENTRY

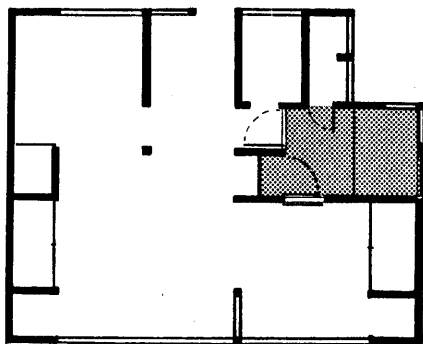
- o Size has been reduced.
- o Combined with other function, such as circulation.



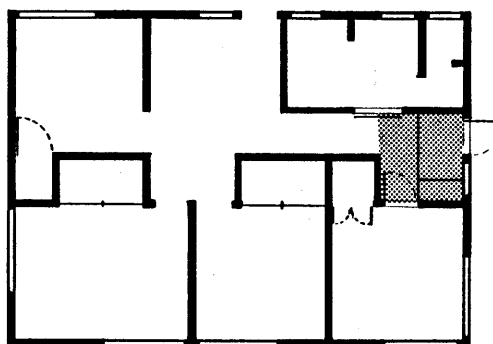
| | Traditional | Intermediate | Modern |
|------------|---|---|--|
| Location | - Transverse side of the house. | - Any possible place. | - Any possible place. |
| Size | - Aver. 1,800x2,700 - 10% of total floor area Approach 5% Receiving 5% Total 10%  | - Aver. 1,800x1,800 - 5% of total floor area Approach 2.5% Receiving 2.5% Total 5.0%  | - Aver. 1,800x2,700 - 5% of total floor area Less than 80m ² More than 80m ² Approach 3.5% Approach 2.5% Receiving 1.5% Receiving 2.5% Total 5.0% Total 5.0%  |
| Elements | - A stepping stone, Shikidai (landing), receiving area, a shoe shelf. | - A shoe shelf | - A shoe shelf - A small rug |
| Function | - Main entry, emphasis was placed on receiving guests. | - Entry for all family members. - Less formal | - Entry for all family members. - Less formal |
| Technology | Door type: Glass sliding doors. Floor cover: Concrete, cut stones, pebbles on the concrete. Introduction of new material, concrete. | Door type: Wooden or metal hollow core door. Floor cover: Concrete or ceramic tiles. - Better illumination | Door type: Wooden or metal hollow core door. Floor cover: Ceramic tiles. - Better illumination |

Note: All dimensions in mm

Traditional

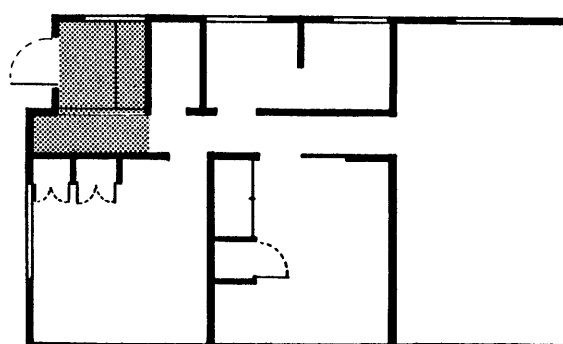


Intermediate



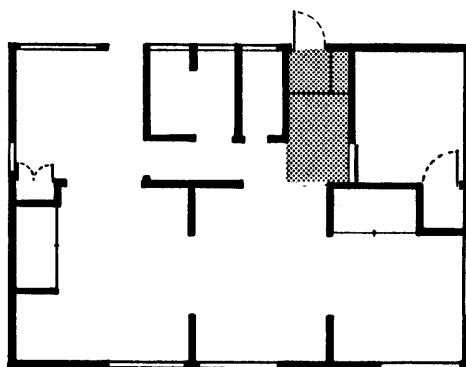
Prototype A

Modern

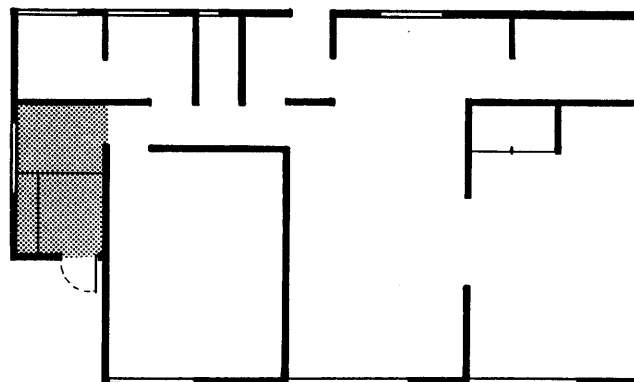


Prototype A

- FIXED WALL
- +— SLIDING DOOR
- MOVABLE PARTITION



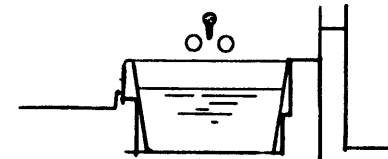
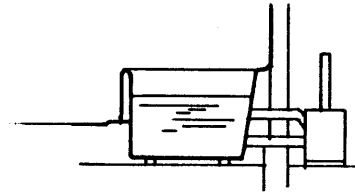
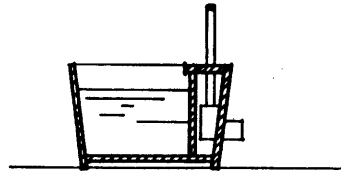
Prototype B

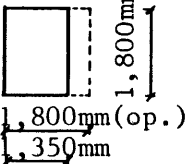
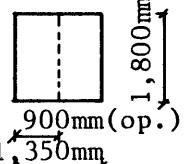
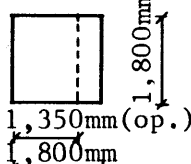


Prototype B

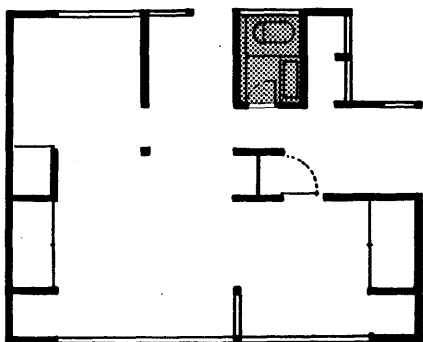
BATHROOM

o Increased in size.

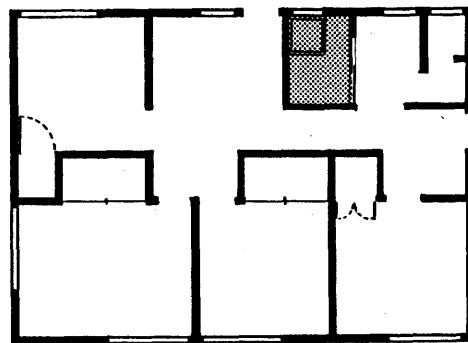


| | Traditional | Intermediate stage | Modern |
|------------|---|---|---|
| Location | - North side of the house. - Only on the first floor. | - North side of the house. - Only on the first floor. | - North side of the house. - First floor and second floor. |
| Size | - 1,800 x 1,350 - 4% of total floor area.  | - Aver. 1,800 x 1,350 Option: 1,800 x 900 - 3% of total floor area.  | - Aver. 1,800 x 1,800 Option: 1,800 x 1,350 - 4% of total floor area.  |
| Elements | - Wooden or steel deep bath tub - A basin (occasionally). | - Tiles on concrete or enameled steel deep tub | - Fiberglass, vitreous china, or enameled steel deep tub - A shower |
| Function | - Bathing - laundry | - Bathing - Laundry | - Bathing - Occasionally the place for laundry machine |
| Technology | Heating method: wood or coal | Heating method: wood, coal, gas | Heating method: gas or central heating - Development of plumbing system and new construction. |

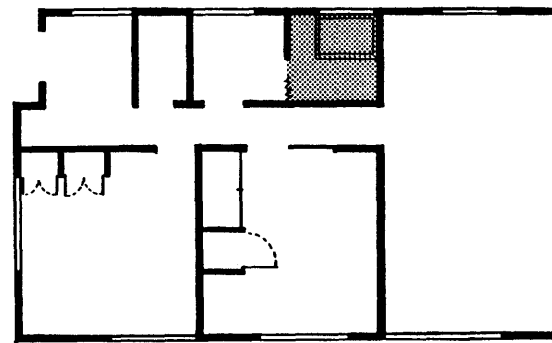
Traditional



Intermediate



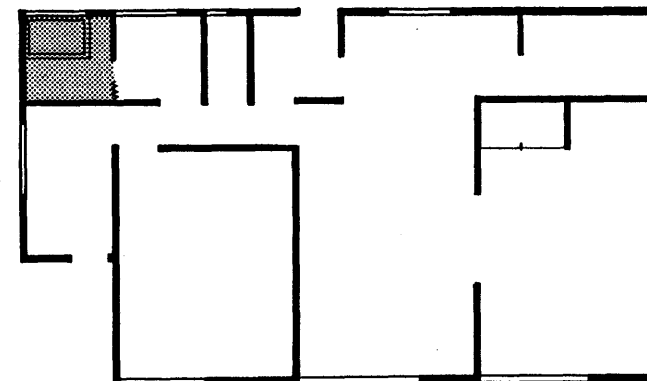
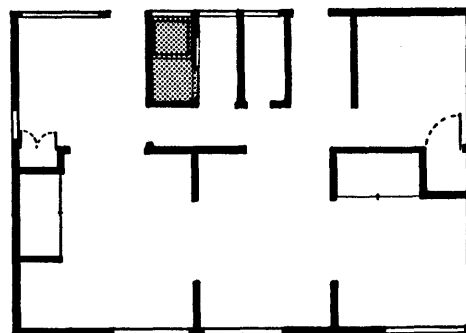
Modern



Ptotype A

Prototype A

- FIXED WALL
- + SLIDING DOOR
- MOVABLE PARTITION

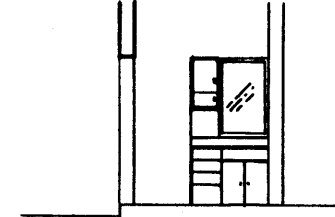
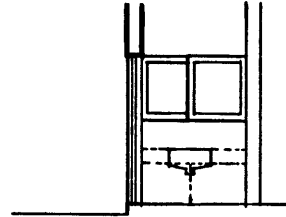
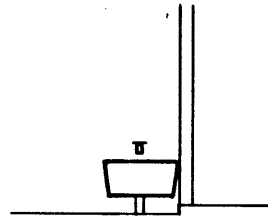


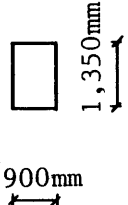
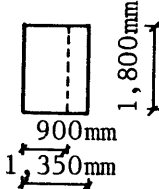
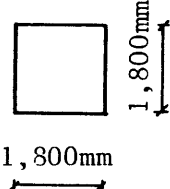
Prototype B

Prototype B

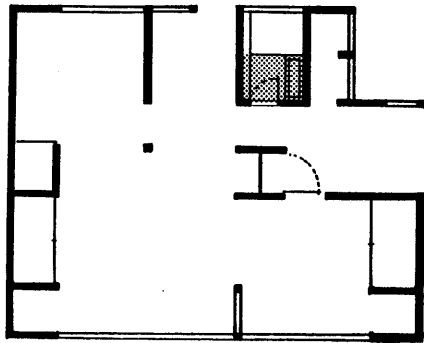
SENMENSHO (Basin area)

o Increased in size.

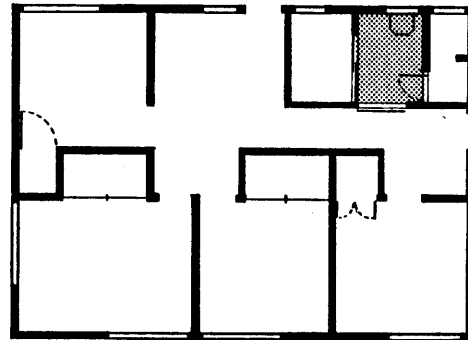


| | Traditional | Intermediate stage | Modern |
|------------|---|---|--|
| Location | - In the bath room | - Next to bath room and lav. | - Access to bath room and lav. |
| Size | - 1,350 x 900 or sink area. - 6% of total floor area.  | - 1,800 x 900 or 1,800 x 1,350 - 3% of total floor area.  | - 1,800 x 1,800 - 4% of total floor area.  |
| Elements | - One concrete sink - A cold water faucet | - One china or tiled sink - A washbasin - A laundry machine | - Cabinet with a fiberglass or china sink - A laundry machine |
| Function | - Washing face and hands. - Laundry place. | - Washing face and hands. - Place for laundry machine. | - Washing face and hands. - Place for laundry machine. - Utility place. |
| Technology | - Development of copper piping. | - Utilization of new materials such as china for a sink. | - Development of unit, basin cabinet, central and local heating system. - Plumbing system for new heat- ing supply. |

Traditional

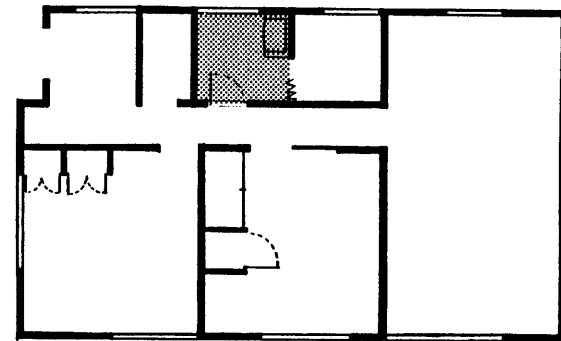


Intermediate



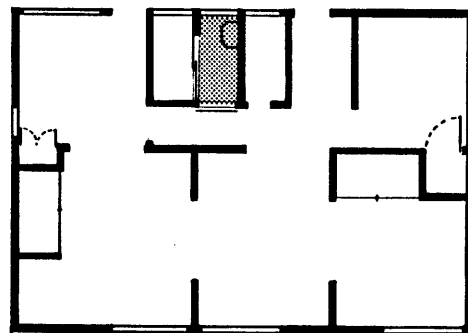
Prototype A

Modern

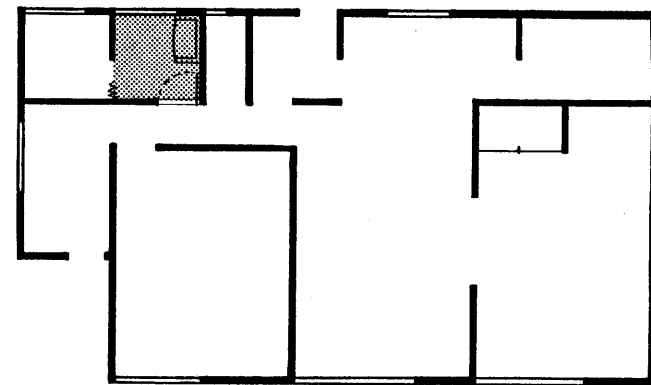


Prototype A

- FIXED WALL
- + SLIDING DOOR
- MOVABLE PARTITION



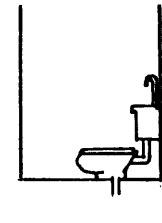
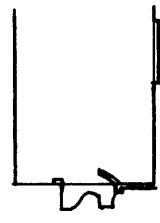
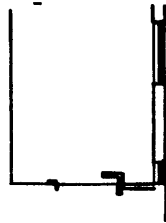
Prototype B

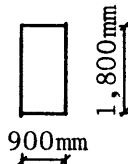
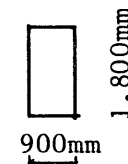
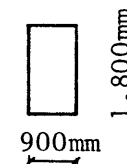


Prototype B

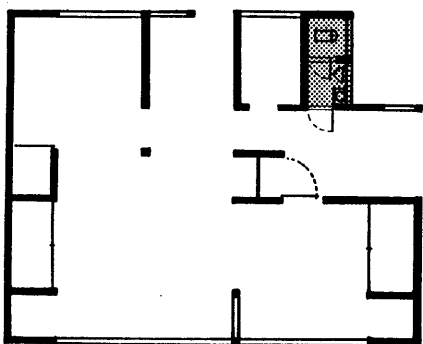
LAVATORY

o Consistent in size.

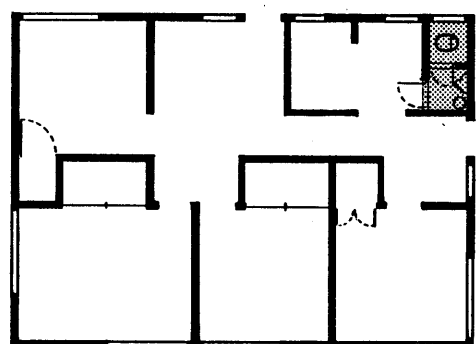


| | Traditional | Intermediate stage | Modern |
|------------|---|---|---|
| Location | - North and first floor. - Separated from bath room. | - North and first floor. - Separated from bath room. | - First floor and second floor. - Separated from bath room. |
| Size | - 1,800 x 900 - 3% of total floor area.  | - 1,800 x 900 - 2% of total floor area.  | - 1,800 x 900 - 2% of total floor area.  |
| Elements | - Traditional wooden stool - A urinal - A small basin sink | - Traditional china stool - A urinal - A small basin sink | - Water closet (both traditional and Western style) with /without basin on the top. |
| Function | - Body functions | - Body functions | - Body functions |
| Technology | - Use of conventional material, wood. | - Use of new material, china. | - Development of sewage system - Ventilation system |

Traditional

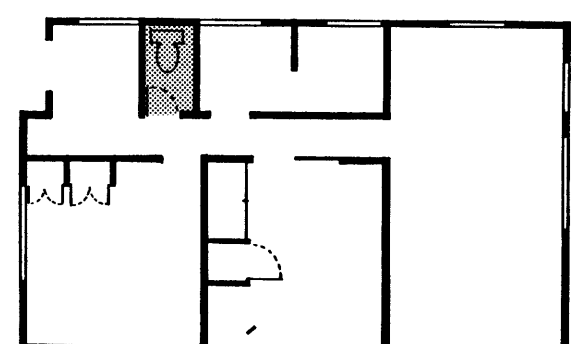


Intermediate



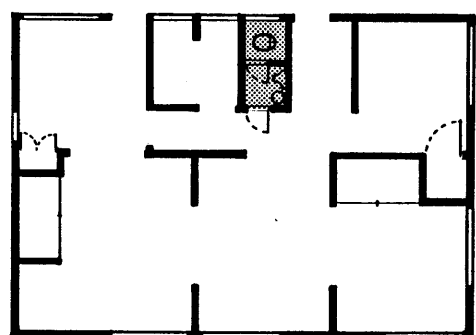
Prototype A

Modern

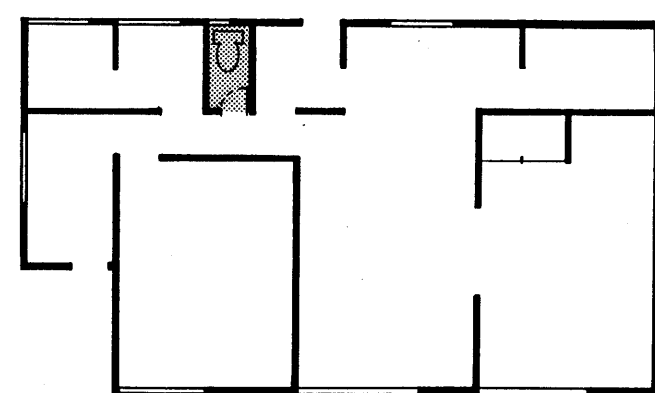


Prototype A

- FIXED WALL
- |- SLIDING DOOR
- MOVABLE PARTITION



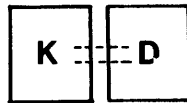
Prototype B



Prototype B

KITCHEN AND DINING

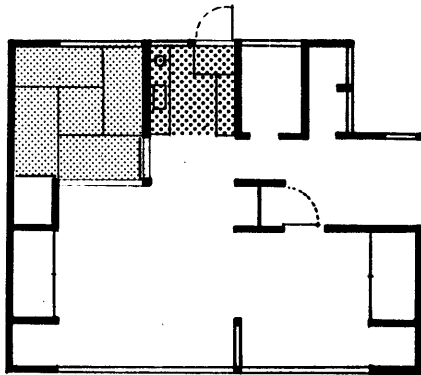
- o Kitchen has become an integrated part of the houses.
- o Requires both more length and depth for kitchen counter.



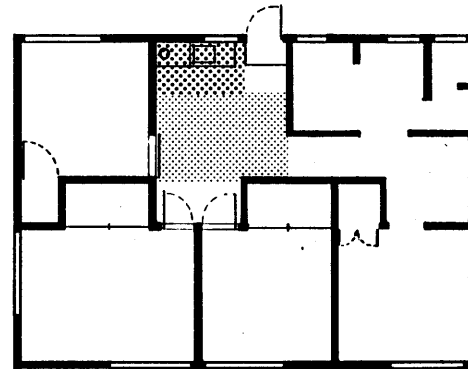
| | Traditional | Intermediate | Modern |
|------------|--|---|--|
| Location | - K and D was separated | - K and D was combined. | - K, D, and L in one space. |
| Size | - 3 mats for K 4.5 mats for D - K: 8% D: 12% Total 20% of floor area | - 4.5 mats for KD. - K: 3% D: 6% Total 9% of floor area. | - 10 to 12 mats for KDL. - K: 5% D: 5% L: 10% Total 20% of floor area. |
| Elements | - A concrete sink, a gas or propane gas stove. | - A stainless sink, two electric or gas ranges. | -Two stainless sinks, four ranges, a oven and a refig. |
| Function | - Cooking, dishwashing. CHANO-MA for eating and chatting. | -Cooking, dishwashing, eating, chatting. | -Cooking, dishwashing, eating place for family & guests |
| Technology | - Use copper and iron plumbing and sewage | - Development of parts, stainless sink. | - Development of units, kitchen unit and plumbing for heating. |

| Traditional | Intermediate | Modern |
|-------------|--------------|-------------------------------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | <u>Note</u> D: Dining area |
| | | |

Traditional

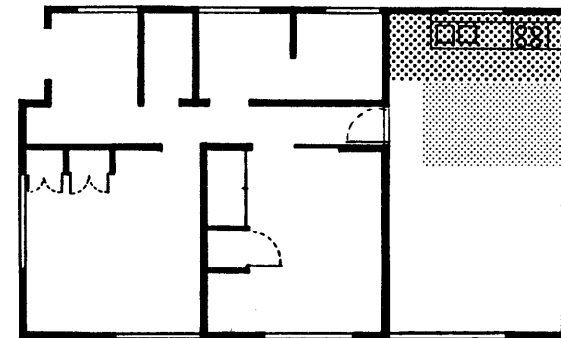


Intermediate





Prototype A

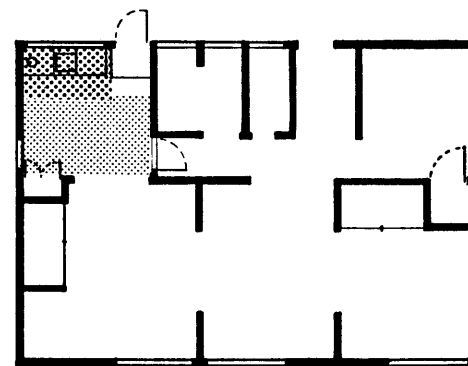
Modern



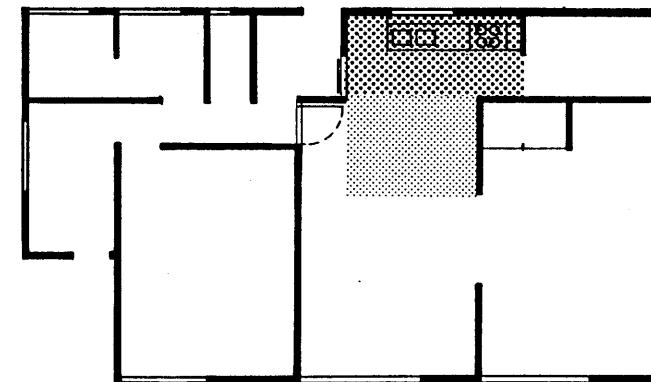
Prototype A

- FIXED WALL
- +— SLIDING DOOR
- MOVABLE PARTITION

-  Kitchen
-  Dining



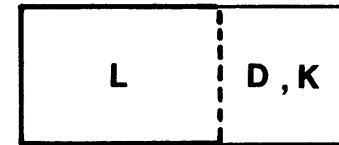
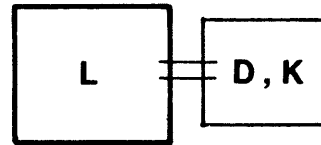
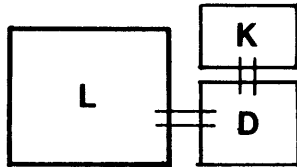
Prototype B

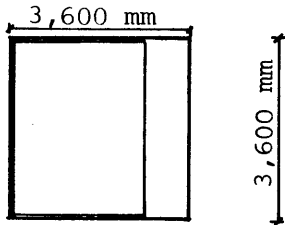
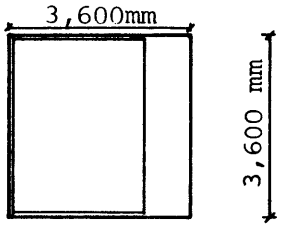
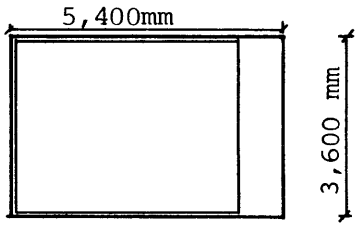


Prototype B

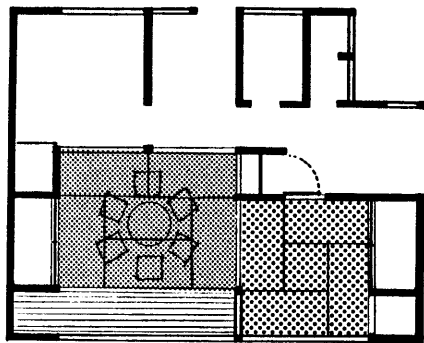
LIVING ROOM

- o Increased in size, more than ten mats.
- o Kitchen, Dining, and living room in one space.

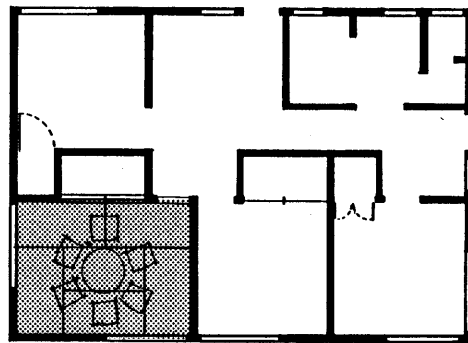


| | Traditional | Intermediate stage | Modern |
|------------|--|--|--|
| Location | - Close to kitchen and eating space. | - Middle of the house or adjacent to kitchen&dining. | - Center or end of the house. |
| Size |  <ul style="list-style-type: none"> - 6 to 8 mats - 20% of total floor area |  <ul style="list-style-type: none"> - 6 to 8 mats - 15% of total floor area |  <ul style="list-style-type: none"> - 10 to 12 mats - 20% of total floor area. |
| Elements | <ul style="list-style-type: none"> - OSHIIRE - ENGAWA | <ul style="list-style-type: none"> - OSHIIRE for tatami room and living room set for Western room. | <ul style="list-style-type: none"> - Living room set |
| Function | <ul style="list-style-type: none"> - Family congregation, chatting. - Sleeping place for parents. | <ul style="list-style-type: none"> - Family congregation, chatting. - Entertainment of guests. | <ul style="list-style-type: none"> - Family congregation, chatting. - Entertainment of guests |
| Technology | <ul style="list-style-type: none"> - Local heating sys.: HIBACHI, KOTATSU. | <ul style="list-style-type: none"> - Local heating sys.: KOTATSU, gas stove, and heater. | <ul style="list-style-type: none"> - Development of heating sys. local heating: heater, petrol and gas stove. - Air conditioner. - Air tight construction |

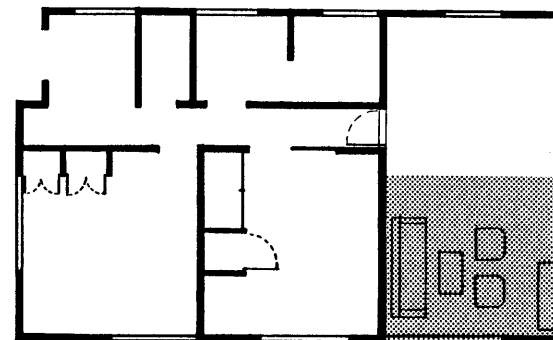
Traditional



Intermediate

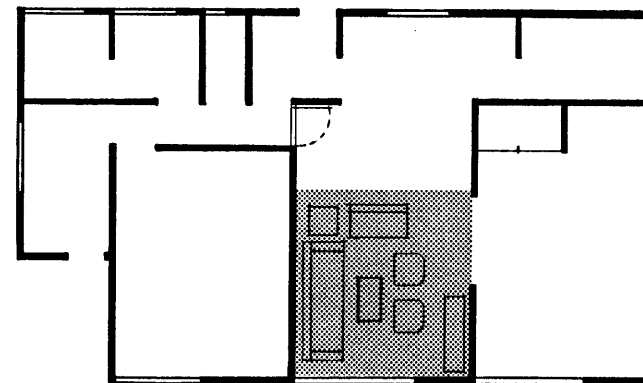
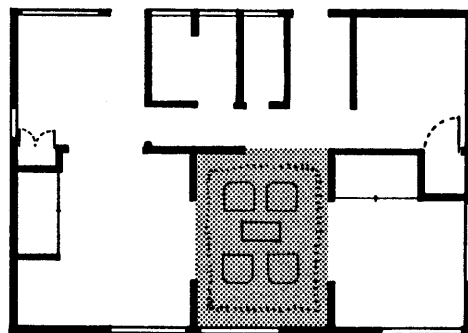
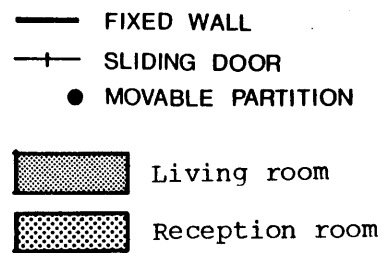


Modern



Prototype A

Prototype A

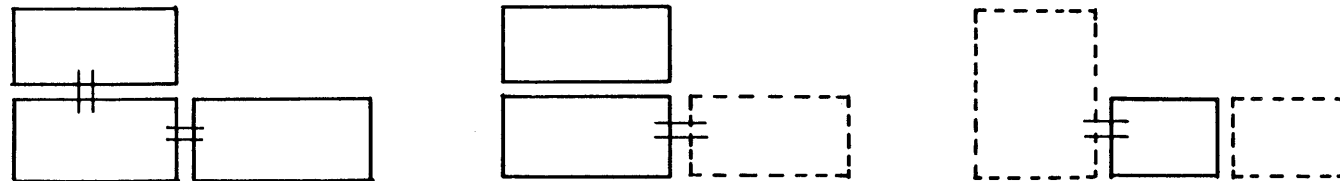


Prototype B

Prototype B

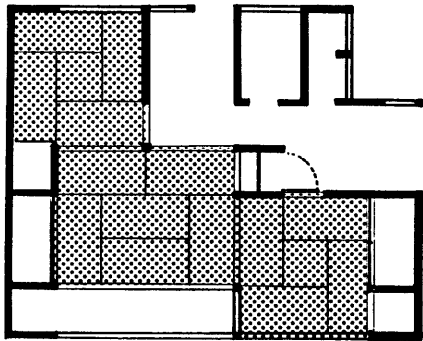
ROOM TYPE: Tatami room

o Number of Tatami rooms has been decreased.

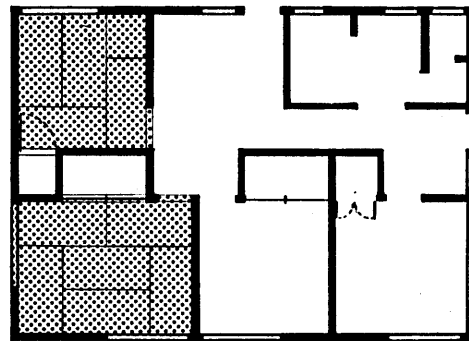


| | Traditional | Intermediate stage | Modern |
|------------|---|---|--|
| Location | - South or south east facing all location. | - Beside the kitchen and dining area. | - Beside the living room or close to the entry. |
| Size | <p>- 4.5 to 6 mats - 90% of total floor area</p> | <p>- 4.5 to 6 mats - 50 to 75% of total floor area</p> | <p>- 6 to 8 mats - 25 to 35% of total floor area</p> |
| Elements | - OSHIIRE - TOKONOMA for ZASHIKI | - OSHIIRE - TOKONOMA in tatami room for living room | - OSHIIRE - TOKONOMA |
| Function | - Room for eating, sleeping, family living room and for reception room. | - Room for each family member. - Parents' sleeping room and living room. | - Spare room for multi-functional room for all occasion. |
| Technology | - Consisting of open components, FUSUMA, SHOJI, TATA-MI, etc. | - Use of panel system, floor panel instead of NEDA. - Use of parts, aluminum frames. | - Air tight construction for heating and cooling effect. |

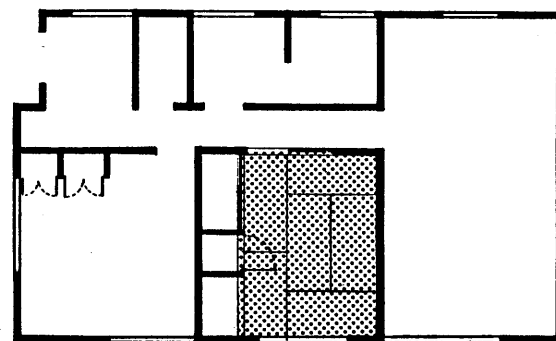
Traditional



Intermediate



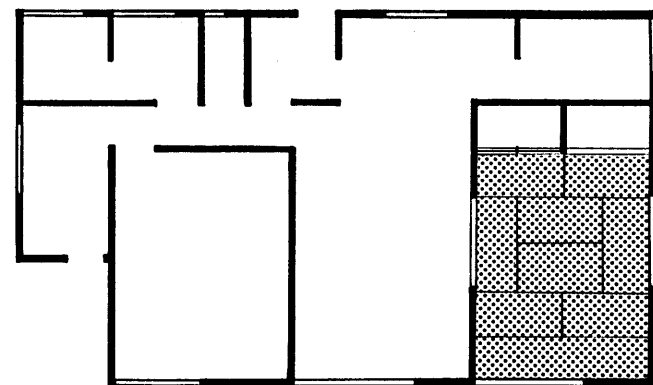
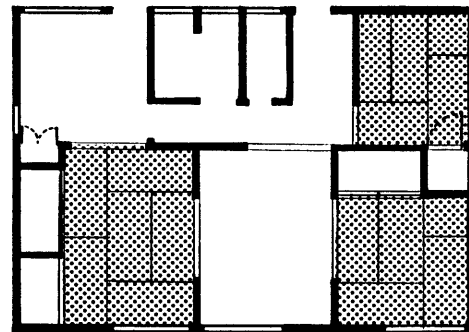
Modern



Prototype A

Prototype A

- FIXED WALL
- + SLIDING DOOR
- MOVABLE PARTITION

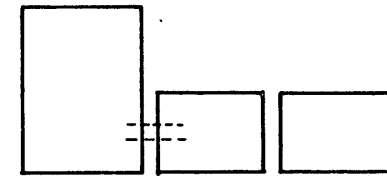
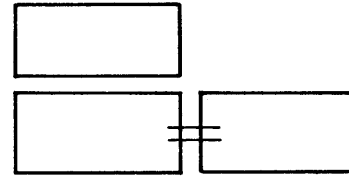
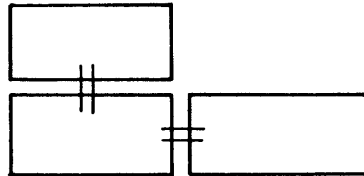


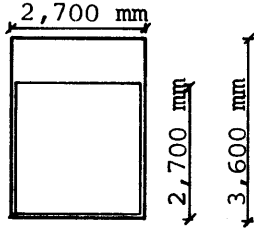
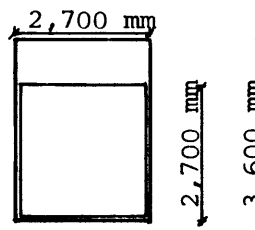
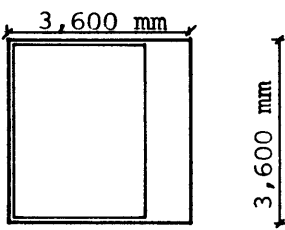
Prototype B

Prototype B

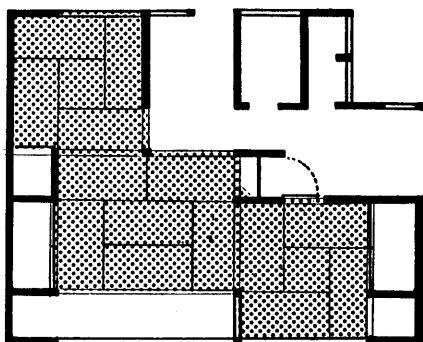
ROOMS

- o Increased size of rooms.
- o Increased independence of each room.

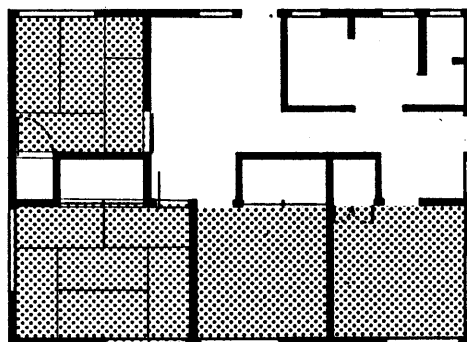


| | Traditional | Intermediate stage | Modern |
|------------|---|--|--|
| Location | - South or south east facing | - South or south east facing | - South or south east facing |
| Size |  <p>- 4.5 to 6 mats</p> |  <p>- 4.5 to 6 mats</p> |  <p>- 6 to 8 mats</p> |
| Elements | <ul style="list-style-type: none"> - OSHIIRE - TOKONOMA in the ZASHIKI (reception room) | <ul style="list-style-type: none"> - OSHIIRE for tatami room. - There is no fixed element in Western style room. | <ul style="list-style-type: none"> - OSHIIRE and TOKONOMA in tatami room. - There is no fixed element in Western style room. |
| Function | - Sleeping, studying, etc. for family members. | - Private room for studying, sleeping, etc. | - Private room for studying, sleeping, etc. |
| Technology | - Use of open components FUSUMA, SHOJI, TATAMI, etc. | <ul style="list-style-type: none"> - Use of panel system and fixed wall. - Development of dry finishing | <ul style="list-style-type: none"> - Use of panel system of light weight concrete panel - Use of fixed wall. |

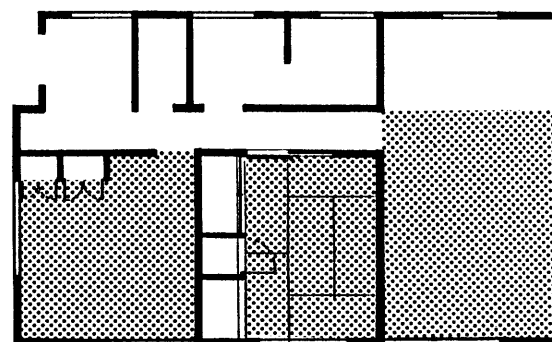
Traditional



Intermediate



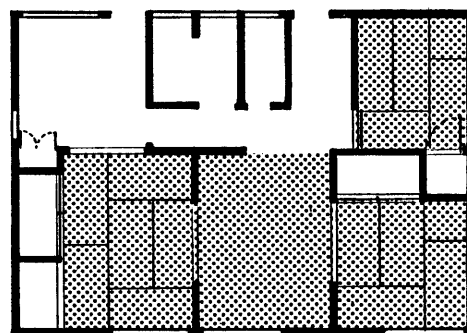
Modern



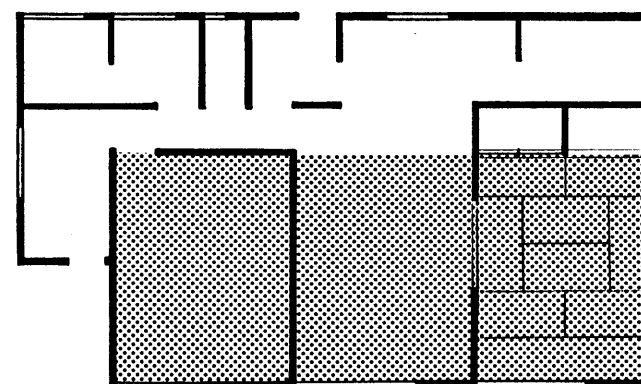
Prototype A

Prototype A

- FIXED WALL
- +— SLIDING DOOR
- MOVABLE PARTITION



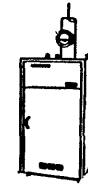
Prototype B

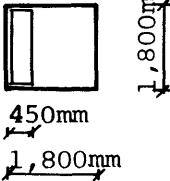


Prototype B

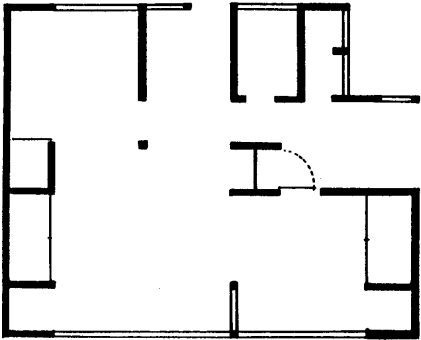
NEW SPACE: Utility Space

o Utility space has been added due to improving economic capability.

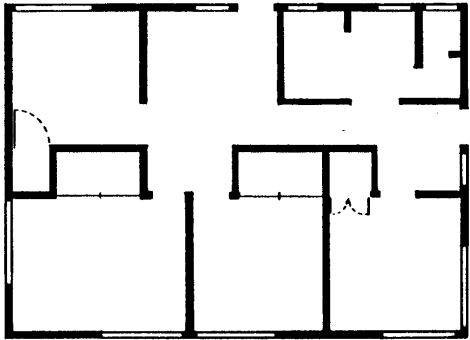


| | Traditional | Intermediate stage | Modern |
|------------|-------------|--------------------|--|
| Location | No | No | Beside the kitchen or in SENMENSHO. |
| Size | No | No | - 1,800 x 450 or 1,800 x 1,800  |
| Elements | No | No | - Local hot water supply or central heating unit. - Boiler and water tank |
| Function | No | No | - Local hot water supply - Central heating |
| Technology | | | - Development of heating unit. - Utilization of solar energy for domestic heating supply. - Improvement of piping sys. |

Traditional

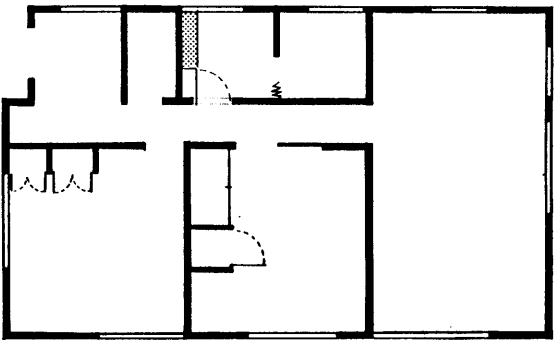


Intermediate



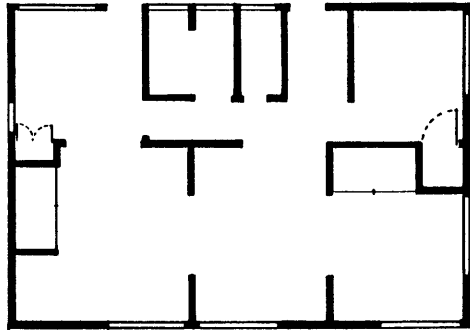
Prototype A

Modern

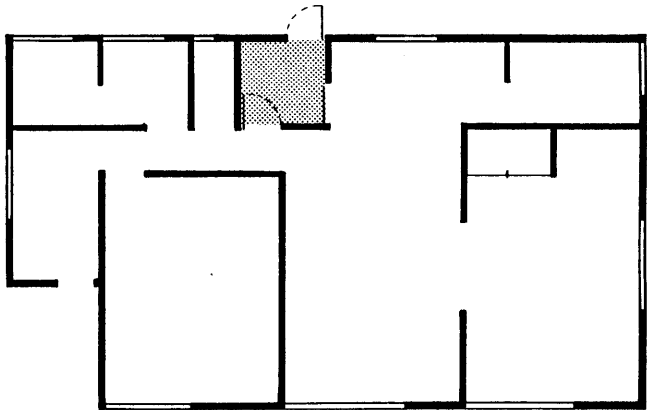


Prototype A

- FIXED WALL
- +— SLIDING DOOR
- MOVABLE PARTITION

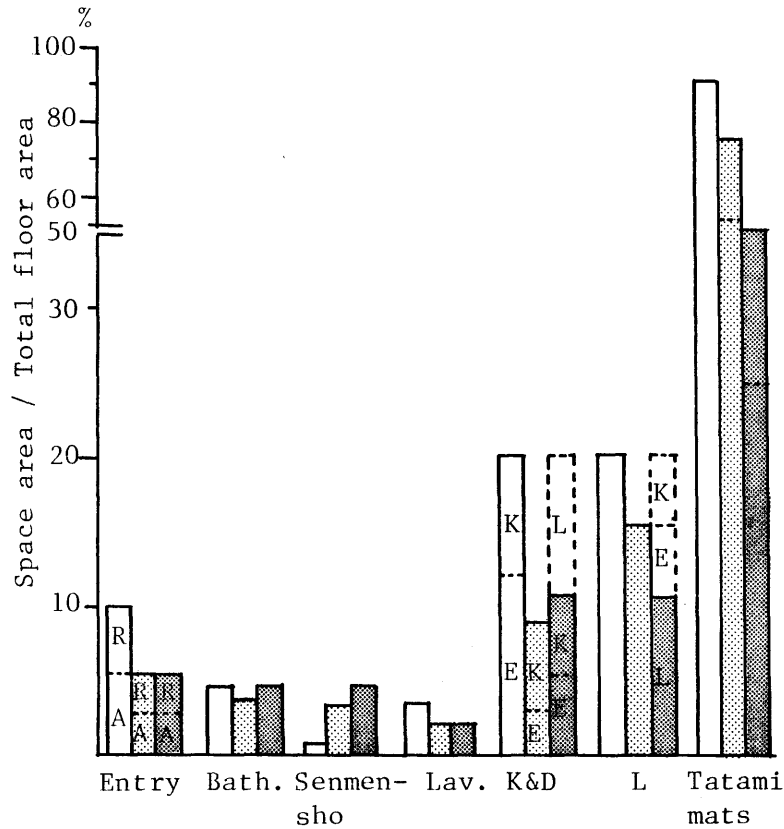


Prototype B



Prototype B

Chart 12.



Legend

R: Reception area A: Approach
 K: Kitchen E: Eating area
 L: Living room D: Dining

■ Traditional
 ■ Intermediate period
 □ Modern

The bar graph at left shows the differences in the percentages of floor area allotted to different kinds of rooms for the three housing types. Each bar shows room size as a percentage of the total floor area of the house. The graph shows that the traditional house devoted relatively more space to the entry, the bathroom, kitchen/eating space and living room. In the traditional house a relatively large percentage of floor area was covered with Tatami mats. However, in the traditional house relatively less area was devoted to the Shenmensho.

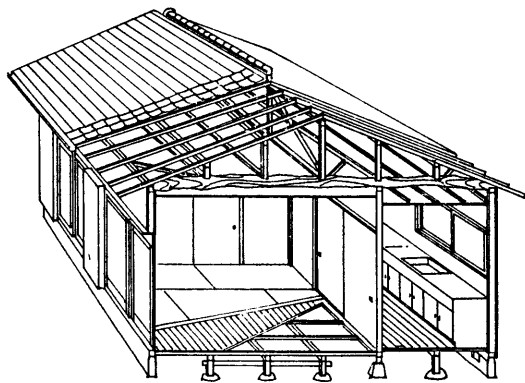
The relative decline of the use of the Tatami mat in intermediate and modern houses in almost all of these categories is compensated by the fact that the newer houses allot more space to Western-style rooms.

5.2 Building System and Materials

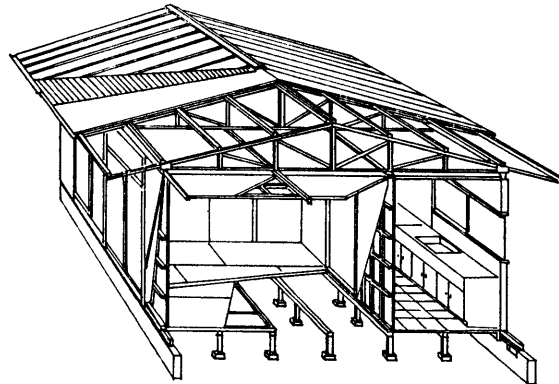
Typical building systems and materials used in the traditional, intermediate period, and modern house are listed on the right page.

It can be seen that the primary building system, the frame system, has not yet changed, but the use of materials has changed, due to the requirement for earthquake resistance. For secondary infill components, the materials for

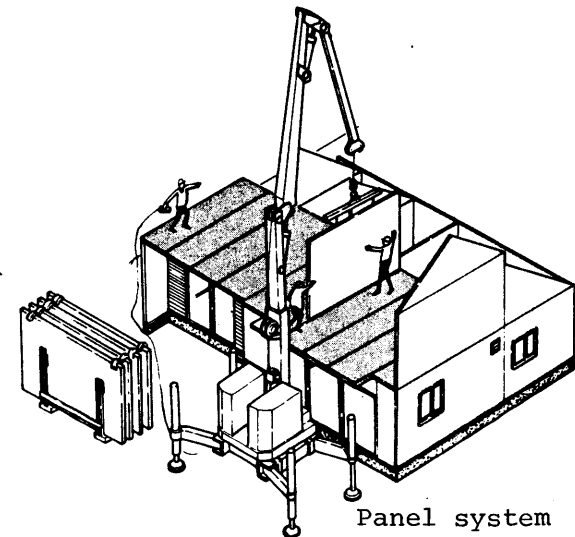
fire safety and the type of components, such as panels for easy installation, have changed significantly with the development of housing technology.



Conventional Wooden Frame Construction



Prefabricated House



Panel system

BUILDING SYSTEM AND MATERIALS

| | | Traditional | Intermediate stage | | Modern | |
|--------|----------|------------------------------------|---|---|--|----------------------------|
| System | | Wooden post-beam | Steel frame | Panel | Steel frame | |
| Wall | Interior | - Clay with sand - Plaster | - plywood (printed grains) - Cloth on lath - Clay with sand | - Plywood (printed grains) - Cloth on lath | - Cloth on lath board - Plywood - Fiber wall - Gypboard | |
| | Exterior | - Wooden panel - Clay with sand | - Aluminum sandwich panel (styrofoam inside) | - Asbestos board sandwich panel | - Light weight foamed concrete panel (ALC concrete, 77mm) | |
| Floor | Base | - NEDA (wooden board) | - wooden panel | - Wooden panel | - Light weight foamed concrete panel (ALC concrete, 100mm) | |
| | Finish | Bath | - Concrete | - Tiles on concrete | - Tiles on concrete | - Mosaic tiles on concrete |
| | | Lav. | - Wood | - Tiles - Mosaic tiles | - Mosaic tiles | - Vinyl sheets |
| | | Kitchen | - Wood - Concrete - Without ground cover | - Vinyl tiles - Vinyl asbestos tiles | - Vinyl tiles - Vinyl asbestos tiles | - Vinyl sheets |
| | | Dining | - Tatami mats | - Vinyl /vinyl asbestos tiles - Wood | - Vinyl/vinyl asbestos tiles - Wood | - Linoleum - Carpet |

5.3 Transformation Factors and Changes

Transformation Factors

Three types of transformation factors influence Japanese residential design:

1. New developments of technology which have led to changing life-styles.
 - 1.1 Development of new building systems using panels, such as wood floor panels and precast concrete (PC) panel systems which are easy to install, to maintain, and to live in. This caused the reduction of the number of Tatami rooms.
 - 1.2 New development of building materials for structural and non-structural components, development of light weight steel together with panel systems, wooden panels, and precast concrete panels, colored metal roofing, and aluminum frame changed the

appearance of houses.

- 1.3 Technical developments of details making it possible to use flat roofs on houses changed the form of houses.
- 1.4 Development of component systems, kitchen units, stainless steel sinks, various prefabricated bathroom units and hollow-core steel doors.
- 1.5 New plumbing and heating systems, hot water supply, new bathing equipment, such as the shower, which requires more space for mechanical equipment and for installation.
- 1.6 Development of new appliances and other equipment: washing machine, dryer, local hot water supply, air conditioner and central heating.

- 1.7 In addition, development of new technology related to energy conservation led to the creation of solar houses and underground houses.

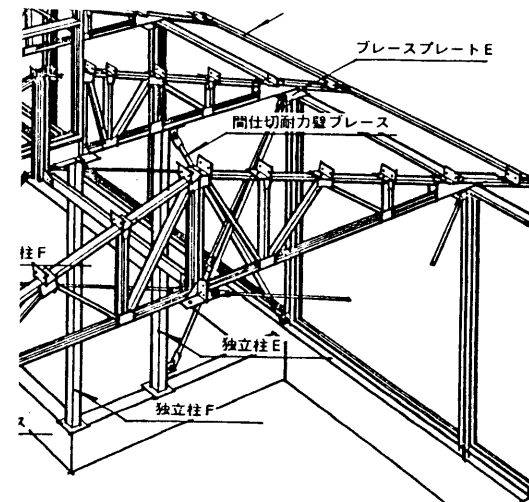
Affected spaces: Kitchen
 Senmensho(basin area)
 Bathroom
 Utility space

2. Changing life-styles have generated new technological solutions (for utilizing such technology) to meet the need of the life-styles. Furthermore, life-style changes from new developments in technology led to a further development of technology in terms of both materials and methods of construction.

- 2.1 Indoor environment has changed because of the introduction of central heating systems and air conditioning, which led to the

use of relatively air-tight construction, materials and components, e.g., fixed walls, aluminum window frames, and doors.

- 2.2 Stronger structural systems, such as the steel frame, allow for longer spans which make it possible to remove the fixed wall between the kitchen and dining room. Common family activities caused the kitchen, dining room, and living area to be combined into one space.



Technological changes that created changes in life-styles in turn caused further technological developments, such as:

- 2.3 The joining of the kitchen to the dining room and living room, which led to the further development of the kitchen as a combined living unit space.
- 2.4 Interior room divider systems ranging from simple panels to a variety of storage cabinets.

Affected spaces: Kitchen
Dining room
Living room

Elimination of physical and spacial elements which relate to the Tatami room.

- 3. Innovations due to available technology and changes in life-style.
- 3.1 Available technology (the panel system of fixed walls) and the changing life-styles (the respect

for the privacy of family members) led to enclosed rooms with fixed walls separated from each other both visually and acoustically, and with limited access to each room.

Although many changes in housing design have occurred, many traditional user expectations have persisted, such as the conception of basic human comfort and differentiation of cleanliness from dirtiness which underlies Japanese thinking and which is embedded in the culture. These are not affected by either technological change or life-style change.

- Retained spaces:
- Separation of lavatory from bath room.
 - Entry where shoes are removed before entering the house.
 - Orientation of rooms, facing south or south-east.

Changes

The most dramatic changes:

- o Spatial organization of kitchen, dining, and living room.

- o Living room size has increased.

Cause: changing family system, role change, and life-styles changed to Western style, using chairs and tables.

- o Each room has become more enclosed by fixed walls.

Cause: Increased recognition of the privacy of individuals was made possible by building technology using dry finishing methods and structural infill components.

- o Increased room size.

Cause: Western style furnishing requires more space, and new equipment has been introduced into daily life, such as stereo, TV, etc.

- o Decreased reception area.

Cause: Man's and woman's role change, as well as common central family activities here influenced the decrease in reception area. Minimum size of entry has been retained in order to accomodate the removal of shoes.

Moderate Changes:

- o Bathroom and Senmensho have become part of each other.

Cause: Western style bathroom and bathing, shower, has influenced Japan, but primary bathing style has not changed; the separation between bathroom and Senmensho has been retained.

- o Increased size of bathroom and Senmensho

Cause: New equipment, shower, washing machine, dryer, and utility space are placed in bathroom or Senmensho. This requires more space for both bathroom and Senmensho.

No changes

- o Lavatory has remained consistent in size and is separated from the Senmensho or bathroom.

Cause: The same dimension is required for the toilet although it has changed from Japanese style toilet to the water closet, both Japanese and Western style. Also, the strong Japanese conception of a clear differentiation of cleanliness from dirtiness resists the combination of the bathroom and lavatory spaces.

Additions

- o Utility space has been added in the Senmensho or next to the kitchen.

Cause: New technology; heating system for interior living environment.

Eliminations:

- o Zashiki (reception room), Engawa, and Shoin and Chigaidana of Tokonoma are often eliminated.

Cause: Changing life-styles with more emphasis placed on life in the Western style living room. This led to the simplification of the traditional Tatami room.

Example for Projected Development of a Single Family House:

General Conditions

Future development of detached houses will continue because there is strong demand for single family housing. The demand will continue because future homeowners express the desire for single family housing. However, future development will be slowed because of the increasingly high cost of suitable land. Therefore, most single family housing will be dependent upon an effective and resource conserving use of the land.

Projected house type:

- A single detached two story house.
- A single attached (row house) two story house.

Building system:

- Frame and panel system.

Material use:

- Non-combustible and earthquake resistant materials, such as steel for structural members and light weight concrete panels for exterior envelope.

Primary structure:

- Steel frame

Secondary infill component:

- Exterior envelope--Light weight concrete panels, such as ALC
- Interior divider--Wooden panels, such as plywood and gypsum dry board. In the children's room, cabinet partitions which allow changing the size of the room to adjust to the growth of the children.

Floor:

- Floor panels which allow the installation and utilization of both exposed wooden floors and Tatami mats covering the floor. Living room: Wooden floor with carpet covering

Dining room: Wooden floor with
carpet covering

Kitchen: Wooden floor with vinyl
sheet covering

Bathroom: Ceramic tiles

Senmensho: Vinyl sheet finish

Lavatory: Vinyl sheet finish

Children's room: Wooden floor
with carpet
covering

Parents room: Wooden floor or
Tatami room

Ceiling:

- Materials with high acoustic insulation properties, together with air-tight construction between the first and second floor levels.

Services:

- o Utility spaces for central heating system, solar system, and other future technological advances in HVAC.

- o Extra space for piping and ducts - Installation of piping and electrical wiring should be provided.

- o Ventilation - Locally controlled ventilation in the kitchen and bathroom.

- o Storage - At least one storage space should be provided for storing furniture and equipment for family use.

- o Alcove space - Alcove space in each room should be provided. This space can be used for closets, Oshiore, storage space for personal belongings, or for placing large equipment, e.g. stereo.

- o Carport - Space for an automobile should be provided in front or on the side of the house.

CONCLUSION

Conclusion

The general trend of industrialized housing has been toward open systems rather than closed systems, although the open system of industrialized housing started from closed systems-- with less variation and flexibility in plans which did not meet changing family needs and life-style -- and led to the development of open systems of industrialized housing. For example, the KEP system of public housing has been developed for open system purposes since 1974. The NPS (New Plan Series), developed from SPH (large panel system which produced monotonous designs, inflexible floor plans for changing family compositions, and required large sites) in order to provide more variation, flexibility of interior plan, and environmentally sensitive site organization.

The reasons for the trend towards open systems are:

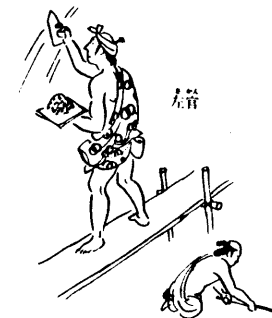
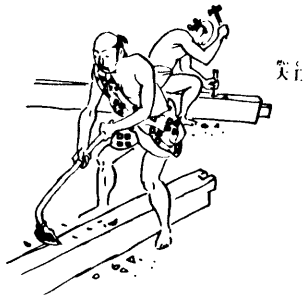
1. The sub-system approach has been developing in both the public and private sectors, and the necessity of further development of sub-systems has been recognized.

The development of sub-systems requires the existence of open systems.

2. Recently, the housing industry has started using small lot production, due to the economical impact on their business after the oil crisis in 1973. This makes for easy development of sub-systems which require small product lots.

Advantages of open systems include:

1. Less expensive than conventional houses through mass production by specialized companies.
2. More variation can be provided through the combination of sub-systems than with a closed system.
3. House construction by self-help becomes possible with open systems which do not require detailed drawings.
4. Cost is held down by self-help; better quality than in custom-made house construction.

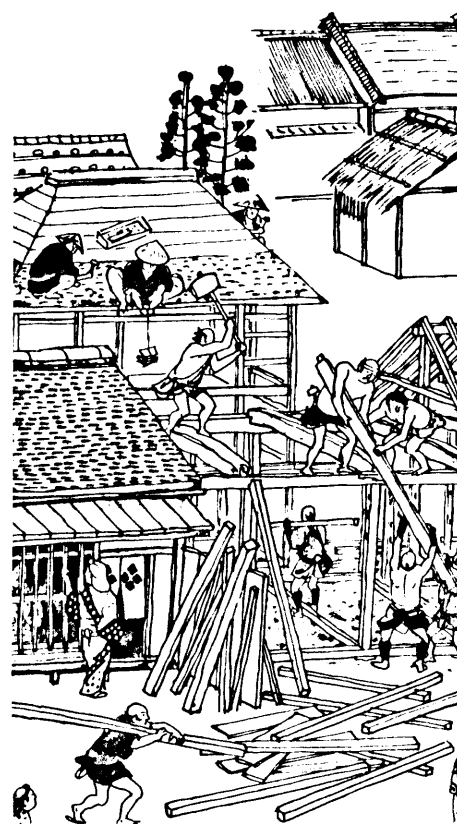


Recently, people have begun to prefer prefabricated houses over conventional houses because of lower acquisition costs, better sub-component performance, and easy to obtain housing loans. In addition, future sub-system developments will improve the value and performance of current industrialized housing. However, clear division of sub-systems for open systems and construction management for controlling sub-systems as a whole are required for the further development of open systems.

Housing design by user participation reflects the occupants' taste and their personality. Most of Minka (house for people) in the Edo period were designed

by carpenters and user participation without plan and detailed drawings. Created by the people, the Minka represents beauty and is generally appreciated as a true expression of Japanese architecture.

The incorporation of technological development, new building materials and building systems such as open systems, and their development into integrated sub-systems, as well as participatory housing design by users according to changing life-styles and family composition, will lead to a new type of Japanese house design which can fittingly be called "Japanese Architecture."



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