ANALYSES OF LONG TERM OCCUPANCY RECORDS
OF PUBLIC HOUSING IN JAPAN

KAZUNOBU MINAMI, PH.D.
Department of Architecture, Shibaura Institute of Technology
3-7-5 Toyosu Kouto-ku Tokyo Japan
k-minami@sic.shibaura-it.ac.jp

Abstract:

The objective of this research is to acquire a basic knowledge of architectural planning, in order to realize the changeability and long-term occupancy sought after for dwellings, from the survey and analysis of actual occupancy records and conditions of apartment buildings over a long period of time. One of the subjects of this survey was households that were long-term occupants of public rental and owned housing estates that were constructed in the 1960s. Analyses were made of how the occupants lived in the dwellings and records of infill improvements, along with changes in the family structures.

The author shows an example of changes in the layout of public housing over 40 years in Japan and examines how the residents have changed the infill according to the changes in their lifestyles. The author believes the study of long term occupancy records will give a useful knowledge to design longer life housing. Families mature and change continuously, and demand adaptability so they can make flexible use of dwellings in which they can live for long periods of time.

This research also examines how the apartment units of a public housing estate, most of which were equipped with movable partitions and movable storage units, have been transformed by the residents since they were built more than 20 years ago. The purpose of this research is to verify whether residents have adopted the design concepts to suit their individual needs and how they have adapted their living environments to changes in their lifestyles over time. Residents’ family structures have changed since the first ones started to live in the apartment house in 1982. Therefore, they have needed to remodel rooms, change the position of partitions, the specifications of equipment, and so on. We studied the movable partitioning system that had been used by residents as it was planned originally. This paper reports on the results of our studies, especially on the changes in room arrangement (layout changes).

Keywords: public rental housing, long-term occupancy records, POE, adaptability, customization, infill improvement
1 STUDY ON LONG-TERM OCCUPANCY RECORDS OF PUBLIC RENTAL HOUSING

1.1 Research purposes

The objective of this research is to acquire a basic knowledge of architectural planning, in order to realize the changeability and long-term occupancy sought after for dwellings, from the survey and analysis of actual occupancy records and conditions of apartment buildings over a long period of time. The subjects of the survey were households that were long-term occupants of public rental housing estates Fujimidai located in the western suburb of Tokyo and constructed in the 1960s. Analyses were made of how the occupants lived in the dwellings and records of infill improvements, along with changes in the family structures. In some apartment buildings that were surveyed, an additional living area had been built onto the balcony side, and as a result of having more living space, young couples with children had moved in (Figure 1, Figure 5-2). On the other hand, apartment buildings that had not had any additions could be occupied by only elderly households. With households that wanted to continue living in the same place for a long term, despite rental housing restrictions, cases could be seen where infill improvements had been actively carried out on the inside in order to improve the habitability.

**Figure 1:** Floor Plan of the Housing Estate Fujimidai which was Surveyed

**Figure 2:** Legend of Room Codes

**Figure 3:** Example of Occupancy Records of Household in Building with an Addition

**Figure 4:** Example of Occupancy Records of Household in Building Without an Addition
1.2 Analyses of Occupancy Records of a Building with an Addition

One of the households surveyed was a long-term occupant household which had occupied their home in 1977 and had lived in their home for 31 years at the time of the survey (Figure 3). The family composition at the time of occupancy in 1977 was a four-person household, M32, F30, f5 and m3 \(^1\). In 1997, the eldest daughter, and in 2002, the eldest son moved out to marry. At the present time, the household is a two-person household, M63 and F61.

Adaptive room modifications were performed four times during the 31 year period. The first was carried out in 1983 to provide private rooms for the children who were maturing. Adaptive room modification, this time accompanied by infill improvement, was done for the second time in 1987 when the building was enlarged. Room E became the parents’ (M42, F40) bedroom, room A (Figure 2) which had been their bedroom until that time became a combined den and private room for the eldest son (m13), and room B which had been used as a living room was changed to the eldest daughter’s (f15) private room. The use of room C was changed by removing part of an interior wall between it and the kitchen so that it and the kitchen could be used as a single room.

Later, when the children became independent in 1997 and 2002, adaptive room modification was done for the third and fourth times. A characteristic of this household is that as each child became independent, rooms were adaptively modified in stages.

1.3 Analyses of Occupancy Records of a Building without an Addition

One of the households surveyed was a long-term occupying household which first occupied the building in 1966, one year after completion of the residential estate, so they had occupied their home continuously for 42 years at the time of the survey (Figure 4). The family composition at the time of occupancy was a three-person household, M24, F21, F'- (grandmother). Their first daughter and first son were born in 1968 and 1971 respectively, and their second son was born in 1973. The household composition in 1973 when their second son was born was a five-person household, M31, F28, F', f5, m2, and m0, and six people was the largest number of members in the occupancy records of this household.

In 1983, the grandmother moved to a separate home in response to the maturation of the children, changing this household to a five-person household, M41, F38, f15, m12, and m10. The eldest son became independent in 1993. In 1995, the eldest daughter left home, changing it to a three-person household, M66, F63, and m35.

They performed adaptive room modification five times during the 42 years. The first time was in 1968 when their first child was born: the parents and the grandmother switched bedrooms. The second and third times, adaptive room modification was done to provide private rooms for the children who were maturing. When the grandmother moved out in 1983, adaptive room modification was done a fourth time, then in 1995, it was done again when the eldest daughter moved out.

Infill improvements done twice during the 42 years were both paid for by the household. When the grandmother moved out in 1983, sliding doors were removed from between rooms A and B, and between room B and the kitchen and replaced with accordion curtains. And a closet in room A was converted into a western style clothes closet.
1.4 Conclusions of this chapter

The occupancy records of each dwelling shows a number of innovative measures which householders take over a period of many years so they can enjoy the limited space in their dwellings more effectively and more comfortably. Families mature and change continuously, and demand adaptability so they can make flexible use of dwellings in which they can live for long periods of time. The author believes that this survey of long-term occupancy records will provide basic knowledge needed to create methods of architectural planning to achieve long-term occupancy.

2 A POST-OCCUPANCY EVALUATION OF LAYOUT CHANGES MADE TO KEP ADAPTABLE HOUSING

2.1 Research purposes

The author investigated the “Tsurumaki -3” housing estate of Tama New Town, a suburb of Tokyo (Figure 5-2). It was the first undertaking of the KEP (Kodan Experimental-housing Project) which the Japanese Housing Corporation started in 1973 in order to research and develop flexibility and adaptability for housing. Since the 1970's, multifamily housing in Japan has been focusing on quality more than quantity. The most important object of our research is to investigate how residents have adopted the design concepts to suit their individual needs and how they have adapted their living environments to changes in their lifestyles over time by remodeling rooms and changing the position of partitions, especially that of KEP movable partitioning system (Table 1). In the Tsurumaki -3 estate, there are 192 units in four-storey flats and 29 units in two-storey terrace houses to own. This paper reports on the survey of the four-storey flats that was implemented in 2005.

2.2 Research methods

First, we developed a questionnaire survey for the residents. We took pictures of the interior layouts of units when we were allowed to do so. We asked the residents if they had altered the room arrangement by changing the position of the KEP movable partitioning system or by using a conventional partitioning system. Similar investigations were performed in 1982 (just after the completion of the estate) and in 1995*.1,*.2 We analyzed the transformation of the room layout of each unit through 23 years by comparing the results of the studies made in 1982, 1995 and 2005.

2.3 Results of the survey

The response rate of the questionnaire (the number of respondents / the number of housing units in the estate) was 51.1%. There are three main types of plans for units in the estate: A, B and C. Type A can be subdivided into types A1 - A3, Type B into types B1 - B5 and Type C into types C1 - C4, for a total of 12 types of units. Type C units are not equipped with the KEP movable partitioning system. We did not study Type B3 because it has not been studied previously. Table 1 shows the plan and the location of the movable partitioning system in each type of unit.

Residents’ interest in permanent occupancy was changing during the 23-year survey period. In 2005, 26.2% of the residents were in their fifties and 17.2% were in their sixties. In more than 40% of all households there was at least one child over 18 and 34% of households had no children. Residents have been aging and families maturing in the estate. As they have aged, their interest in permanent occupancy has increased to the point where 62% of the residents now wish to live in their units permanently.

Figure 6 – 7 and Table 2 -3 show the attributes of the residents (age structure) and changes in their views of permanent occupancy. Figures 2 and 3 indicate that the distribution shape has shifted
to the right by ageing. In 2005, 26.2% of all residents were in their fifties and 17.2% in their sixties. As for family structure, about 40% of all households had at least one child over 18 years old and about 34% of households were childless couples at least 40 years old. The aging of the residents and the maturity of each family were the result of young couples in their twenties and thirties moving in at the time of the completion of the apartments and continuing to live there for more than 20 years afterwards. Eldest child ages rise toward the right of the graphs. Residents of Type C units tended to reside longer than residents of type A or B units which had been equipped with the KEP movable partitioning system.

Table 2 indicates that the interest in permanent occupancy has increased and 63% of residents were thinking of living permanently in their units in 2005. Table 3 shows the changes in concepts of permanent occupancy of the residents who have lived there continuously since 1982. Similar to Table 2, interest in permanent occupancy has risen. The residents seem to have become more willing to live in their units as long as possible as they aged.

2.4 Changes in the room arrangement
2.4.1 Rates of room arrangement changes
Both the KEP movable partitioning system and a conventional remodeling system were used to make changes in the room arrangement. Residents of 29.5% (26/88 Note2) of apartment units have made some changes to their room layout. Residents of 38.8% (14/36) of Type A units and 47% (9/19) of Type B units have made at least some room layout changes. On the other hand, only 9% (3/33) of residents of Type C units (which do not have the movable partitioning system of the A and B units), have made room layout changes. In most cases, the room layout has been changed in order to make the living room or private room larger and it has been residents whose children have left home who have made the layout changes. By 2005, the children of many households in the estate had already moved out. The KEP system, which allows a living room or a private room to be enlarged by moving the partitioning wall and/or partitioning storage walls separating two rooms, has been adapted well to the changing needs of residents.

2.4.2 An example of the room arrangement changes in a Type A unit
Figure 8 shows the changes in the layout of a Type A (A3) unit that have been made since 1982. The diagram illustrates the use of a room, location of movable partitioning wall, family member attributes (M: man, F: woman, m: boy, f: girl) and their ages (number shows age). In 1982, this family had pre-school children. In the ensuing years, the children entered school, finished school and left home. In 1995, the mother started to give piano lessons at home and moved the partitioning storage walls to connect the living room with the adjoining private room to make a large single room. This example shows how the KEP system has allowed residents to tailor their living spaces to meet their individual needs.

2.4.3 An example of the room arrangement changes in a Type B unit
Figure 9 shows an example of the layout changes in a Type B (B4) unit. This family has also been living in this unit since 1982. In 1982, their children were of school age, but finished school and left home afterwards. When the children left home, this family moved the partitioning storage walls and connected the living room with the private room to make it larger.
Figure 5-1: Housing Estate Fujimidai

Figure 5-2: Tsurumaki -3 Estate

Figure 6: Age Structure of Residents

Figure 7: Family Type of Residents

Table 3: Changes in interest in permanent occupancy (Families who have lived in a unit since 1982)

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>1982</th>
<th>1995</th>
<th>2005</th>
<th>Unit Type</th>
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<th>1995</th>
<th>2005</th>
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<td>undecided</td>
<td>undecided</td>
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<td>C1-5</td>
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Table 1: The plan of each type and the location of the movable partitioning system
①: KEP movable partitioning system  ②: KEP movable storage system
NA: Not available

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<thead>
<tr>
<th>Type</th>
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<th>Type A3</th>
<th>Type B1</th>
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<td>Living room-Private room</td>
<td>Multi purpose room-Kitchen, Living room-Private room</td>
<td>Private room-Storage</td>
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<td>Type B3</td>
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<tr>
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<td>Not studied</td>
<td>Private room-Private room, Living room-Private room</td>
<td>Private room-Private room</td>
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<tr>
<td>Type C1</td>
<td>Type C2</td>
<td>Type C3</td>
<td>Type C4</td>
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Table 2: Interest in Permanent Occupancy (% of all answers)

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<th>Temporary occupancy</th>
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<th>Number of answers</th>
</tr>
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<td>13</td>
<td>50</td>
<td>0</td>
<td>135</td>
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<tr>
<td>1995</td>
<td>48</td>
<td>9</td>
<td>41</td>
<td>1</td>
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<td>2005</td>
<td>63</td>
<td>5</td>
<td>30</td>
<td>2</td>
<td>93</td>
</tr>
</tbody>
</table>
2.5 Analysis of the room arrangement changes

2.5.1 Room layout changes to make a living room larger

The residents can make their living rooms larger by changing the position or removing the movable partitioning walls and/or the movable partitioning storage walls. 10 families made their living rooms larger by using the KEP system, while two families used a conventional method. Nine of these 12 families, including eight of the 10 families who used the KEP system, started to live in this estate in the 1980’s. Many families have made their living room larger, especially after their children left home and they got an extra room in their unit.

The 1995 survey included examples of families who had changed the layout of their unit when they came to live in this estate. At the time, children of those families were still young, mostly preschoolers. These families connected their living rooms with the adjoining private room in order to make a large single room.

2.5.2 Layout changes to make private rooms larger

As the case with their living rooms, residents can make their private rooms larger by moving the partitioning wall and/or partitioning storage walls. Residents of eight of 11 units who changed a private room layout used the KEP partitioning system. Many of the residents who made their private rooms larger had moved to the estate some years after its completion in 1982. Although the 1995 survey noted that many families enlarged the private rooms in order to tailor the room arrangement for their way of living at the time they came in, not to fit it to changing needs in the future, the 2005 survey found that many of the residents changed the room arrangements to give enough space for their children who entered school or to use children’s rooms for other purposes after the children left home.

2.5.3 Layout changes to increase the number of rooms

In this paper, we used the expression “layout changes to increase the number of rooms” to refer to the re-installment of KEP movable partitioning walls and/or partitioning storage walls which had at one time been removed. We found two examples of them in the 2005 survey. When they moved into their unit, one family re-installed the partitioning walls which had been dismantled by the previous residents. The other family dismantled the partitioning walls and partitioning storage walls once and reinstalled them as their children grew older.

The survey in 1995 showed that the number of children’s rooms had increased as the children grew, resulting in an increase in the total number of rooms in an average unit. Many of the families who changed the room arrangements had children whose ages were late teens.

2.6 Conclusions of this chapter

We studied the post occupancy changes in housing units which had a KEP movable partitioning system. As children grew, and when they left home, many families used the KEP partitioning system to adjust the room arrangements to fit the changes in their lifestyles. The KEP system appears to have worked the way it was planned to more than twenty years ago. Some of the residents told us that some of the mechanical parts of the movable partitioning system had become rusted and did not work well enough for them to move and/or reinstall by themselves. There were also residents who thought the sound insulation performance of the movable partitions was not good enough because of the joints between the partitions. They did not think it would be worthwhile to sacrifice the sound insulation performance of the partitions for the sake of movable partitions that would likely be used only once in 10 years. The residents’ experiences and comments suggest important topics for us to research further.
**Figure 8:** An example of the room arrangement changes in a Type A unit
(The symbols M, F, f in the figure show the rooms where the residents slept.)

**Figure 9:** An example of the room arrangement changes in a Type B unit
The dashed lines indicate the possible position for the movable partitioning system
3 CONCLUSIONS

The lengthening of the life of a house is believed to be useful to reduce the consumption of natural resources and the economical burden of housing expenses for families. This is the inevitable approach for future housing in Japan. The research and development to increase the adaptability for housing is not new at all but there has not been enough research to examine the results of the experimental projects afterwards. The author has been trying to compare the occupancy records of experimental projects such as Tsurumaki-3 in Tama New Town and ordinary public housing such as Fujimidai to analyze the differences between them. The author observed the facts that even in rental housing without any movable partitioning building system, households tend to modify their infill to meet changes in family structures and lifestyles. This adaptability is the most important factor to enable households to live in their housing for a longer time.

As the number of people in households has been decreasing and most of the housing in large cities in Japan is occupied by only one or two people, the necessity for adaptability may be different from what it used to be. Nowadays, much housing in Japan requires remodeling to meet the needs of young, small families as well as those of senior families without children. The author believes that it is important to study how households change their living environments in order to find proper design methods and technologies which will continuously enable the needs of each family to be met in the future.

NOTES
*1: The symbols M, F, f in the figure show the rooms where the residents slept.
*2: The number of effective answers

REFERENCES

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