Verification of the Infill Systems in the Skeleton Rental Housing built in 1999 -Through a Case of Flex Court Yoshida-

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Abstract
‘Flex Court Yoshida’ was built as a superior 53-unit rental housing complex for moderate income people by Osaka Prefectural Housing Corporation at the Yoshida area of Higashi-Osaka in 1999. The concept of skeleton-infill system was applied to this housing complex. In the housing complex, new infill systems were developed in order to secure the flexibility not only for the initial dwellers but also for all subsequent dwellers. An infill physical system is classified into variable infill, which can be changed by dwellers, and fixed infill which cannot be changed. In addition, an infill management system (IMS) was also developed in order to support dwellers and to promote reuse of variable infill.

In this research, we aimed to verify the progress of the infill systems at Flex Court Yoshida in 2016. As results of this research are as follows; 1) Instead of not purchasing variable partitions, most dwellers were able to realize various plans, which are adapted to their lifestyles, by utilizing wide living room and arranging freely movable storage furniture. 2) The infill management system disappeared several years after the start of management due to low needs for segment, to change of the infill managers and to discontinuation of infill manufacturing.

Keywords: Skeleton Rental Housing, Infill Management System, Variable Infill, Movable Storage Furniture

1. Introduction

Skeleton-infill housing system was developed in order to give solution to the modern problem of flexibly responding to diversified demands for housing, establishing social basis of housing as public housing complexes realized. In this housing system, the skeleton (support) which has social nature is separated from the infill (fit-out) such as interior furnishing which has individuality. The housing system has three meanings; flexible housing, long life housing and device for community planning.

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In the 1980's, infill development for skeleton rental housing complexes stressed physical systems that ensured individuality when a new household took up residence. However, since the 1990’s, greater emphasis has been placed on ensuring that infill can be adjusted during occupancy in order to meet the changing needs of dwellers. Emphasis has also been placed on reusing infill parts to reduce the burden on the global environment. In the skeleton rental housing of those days, initial dwellers can select infill adapted for their lifestyles, but infill for all subsequent dwellers was greatly limited because they have no choice but to inherit initial infill. There were two problems; the lack of management systems and the physical problems associated with currently available systems.

‘Flex Court Yoshida’ was built as a superior 53-unit rental housing complex for moderate income people by Osaka Prefectural Housing Corporation in 1999. Fig.1 shows the outline of Flex Court Yoshida. The concept of skeleton-infill system was applied to this housing complex. New infill systems were developed in order to secure the flexibility not only for the initial dwellers but also for all subsequent dwellers. An infill physical system was classified into variable infill, which can be changed by dwellers, and fixed infill which cannot be changed. An infill management system was also developed in order to support adaptation of dwellers’ lifestyles and re-use of the infill.

In this research, we aimed to verify the progress of the infill systems at Flex Court Yoshida. In 2016, we conducted a questionnaire survey and an interview survey for dwellers, and an interview survey for staffs of Osaka Prefectural Housing Corporation.

2. The Infill Systems of Flex Court Yoshida

Fig.2 shows a building system of Flex Court Yoshida. It is divided into three subsystems of skeleton, cladding and infill. Infill can be classified into fixed infill and variable infill. Fixed infill consists of finished walls, water piping, fixed storage units like closets, ceilings and floors. Variable infill consists of movable storage furniture, variable partitions and fittings. Fig.3 shows the examples of variable infill. Movable storage furniture is owned by Osaka Prefectural Housing Corporation and is leased to the dweller for use as the dweller pleases. Variable partitions and fittings can be purchased by dwellers from 3 infill supply companies.
An infill management system (IMS) was developed in order to support dwellers and promote reuse of variable infill. Fig.4 shows the concept of IMS. It is performed by an infill manager who concluded the management contact from his intermediary position between all concerned parties. Fig.5 shows the composition of IMS. This form of management provides ongoing support to dwellers in terms of supplying and using infill in order to improve the value of the property not just initial dwellers, but for all subsequent dwellers. It also promotes efficient reusing of variable infill mainly to reduce the burden on the environment and to make better use of natural resources. Table.1 shows the concrete IMS contents at Flex Court Yoshida.

### Table.1. IMS Contents at Flex Court Yoshida

<table>
<thead>
<tr>
<th>Function of IMS</th>
<th>Developed System at Flex Court Yoshida</th>
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<tr>
<td>Support tools</td>
<td>The dwelling and room arrangement selection support system was developed and managed as support tools. This system was operated as a CD-ROM.</td>
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<tr>
<td>Infill coordination</td>
<td>Consultation system with dwellers in purchasing and changing variable infill was established.</td>
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<tr>
<td>Price control</td>
<td>Standard for price calculation of used variable infill was established. And, a system to check and assess the status of used variable infill was established.</td>
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<td>Transfer mediation</td>
<td>A system, that infill manager mediates between stakeholders (dwellers, another dwellers and infill suppliers) in purchasing variable infill, was established.</td>
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<tr>
<td>Management control</td>
<td>A system to make decisions on storage and disposal of variable panel was established. A warehouse to store variable infill was secured in Flex Court Yoshida.</td>
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### 3. Arrangement analysis of variable infill

We conducted a questionnaire survey and an interview survey for dwellers in order to evaluate the infill physical system. We were able to get answers from 27 dwellers in the questionnaire survey (Response rate: 57.4%). In this questionnaire survey, we asked the arrangement of variable infill and furniture. Furthermore, we conducted the interview survey on 5 dwellers. In the interview survey, we asked more detail about utilization of variable infill.

Fig.6 shows 27 plans of the dwelling units, which we got in this questionnaire survey. There was only one dwelling, who continued using the variable partitions. Instead, most dwellers selected various plans by arrangement of movable storage furniture. Because the wide living room was evaluated, there were few dwellers who purchased the partitions.

In type-A units, there were three dwellers using movable storage furniture as partitions and they made storage spaces or bedrooms. Other 11 dwellers used movable storage furniture along the walls. In type-D units, 5 dwellers used movable storage furniture as partitions and other 5 dwellers used the movable storage furniture along the walls. Because the living room of type-D is wider than that of type-A, the need to segment the space also occurred. In type-M units, 3 dwellers used movable storage furniture along the walls while dispersing it in multiple room. Type-M units have prepared multiple rooms and it was not a large living room, so it seems that there was no need to partition.

There were only two dwellers, who arranged movable storage furniture at the same position, and the installation position is determined according to the dwellers’ own lives. The diversity of the movable storage furniture arrangement is confirmed and it can be considered that the movable storage furniture has effectiveness.
Fig. 6. 27 Plans of the Dwelling Units
Fig.7 shows the interview results of 2 dwellers, who had moved the movable storage furniture.

A dweller of case 1 had moved movable storage furniture as a change of pace. All furniture in the dwelling was attached castors and he had frequently made the remodeling. However, he commented that he might not move the movable storage furniture anymore due to the scratches on the floor and the broken adjusters.

Dwellers of case 2 had moved movable storage furniture along with the growth of their child. When the child was a baby, it was trying to raise the efficiency of air conditioning and heating by segmenting the living room. And as the child grew, they moved the movable storage furniture so that only the sleeping space can be secured in order to make use of the wide living room. However, when they moved the movable storage furniture, they did not use the adjusters. It was suggested that moving method of the furniture was not accurately explained to dwellers.

More than 15 years, which has been set as the life of the variable infill, have already passed, and the aged deterioration of parts has become clear as a problem of the movable storage furniture.

![Fig.7. The Results of the Interview Survey](image)

### 4. Operation of Infill management in Flex Court Yoshida

We conducted an interview survey for staffs of Osaka Prefectural Housing Corporation in order to clarify the operation of IMS. In 2016, IMS was not inherited. So, we surveyed the factors that IMS had been disappeared. In this survey, three factors were confirmed.

First factor is attributed to dwellers. When IMS was started in 1999, only 5 dwellers purchased and installed variable partitions. Thereafter, no dwellers purchased new variable partitions from the infill suppliers. As mentioned in the previous chapter, because dwellers highly evaluated the wide living room, dwellers’ needs to
purchase the variable partitions were not very high.

Second factor is attributed to infill managers. The initial infill manager seemed to understand the contents of IMS, but the infill sales were not carried out while the initial infill manager was in charge. When the infill manager changed in a few years, it is thought that support work was not handed over. So, information of IMS was not provided to dwellers excluding initial dwellers.

Third factor is attributed to infill suppliers. Two infill supply companies ceased manufacturing variable infill by 2002, and the other company ceased manufacturing variable infill in 2004. It made impossible for dwellers to purchase variable partitions in five years.

5. Conclusion

(1) Effectiveness and problems of movable storage furniture

In Flex Court Yoshida, most dwellers didn’t purchase variable partitions. However, by utilizing wide living room and arranging freely movable storage furniture, dwellers were able to realize various plans which are adapted to their lifestyles. Considering that the main reason for the move is not a change in the life stage, it can be said that movable storage furniture was effective as a means to realize various plans rather than the variability over time.

Meanwhile, more than 15 years, which has been set as the life of the variable infill, have already passed, and the aged deterioration of parts has become clear as a problem of movable storage furniture.

(2) Factors that IMS was disappeared

IMS in Flex Court Yoshida disappeared several years after the start of management. Three main factors were revealed. First, because dwellers highly appreciated the wide living room, their needs to purchase the variable partitions were not very high. Second, purchasing of partitions became impossible because the manufacture of variable partitions ceased in a few years. Third, since infill sales did not occur during the initial infill manager was in charge, IMS was not inherited when the infill manager changed in a few years.

Notes
We write this paper by updating our previous reports (references 1 and 2).

References
5) Osaka Prefectural Housing Supply Corporation(1999) New generation housing system Flex Court Yoshida
6) Stephen H. Kendall and Jonathan Teicher(2001) Residential Open Building(Cib), Taylor & Francis