Regeneration with Dwelling Unit Enlargement of Public Housing in Japan

Kozo KADOWAKI, Seiichi FUKAO and Tsuyoshi ARAHIRA
Department of Architecture and Building Science
Tokyo Metropolitan University, Japan

Abstract: In Japan, there is growing demand for renovation of the deteriorating housing estates built in the mass-housing era. Although the houses were originally designed for nuclear families, they are now considered too small to accommodate more than three residents. Dwelling units are often enlarged by removing partition walls or by constructing extensions. This paper outlines trials of housing renovation with dwelling unit enlargement in Japan.

Keywords: deteriorating public residential buildings, renovation, dwelling unit enlargement

1. INTRODUCTION

In Japan, various government authorities and public housing corporations built a huge number of dwellings to reconstruct the war-damaged cities and to accommodate the high concentrations of population in urban areas in the mass-housing era between 1955 and 1973. Approximately 40% of all public housing in Japan was constructed in the latter mass-housing era (1965-1973), and they are four or five storied reinforced concrete buildings. The building frames are sufficiently strong to withstand several decades more use but their interior finishings and functional systems are deteriorating. In order to continue to provide comfortable accommodation, these dwellings require regeneration.

Almost all the public housing built in the mass-housing era are from 30 to 50 m^2 in area. Although they were originally designed for nuclear families, now they are considered too small to accommodate more than three residents. Dwelling units are often enlarged by removing partition walls or by building extensions. Local authorities and public housing corporations started such dwelling enlargement works from the 1980s. In recent years, several local authorities have added new elevator towers and the like for aged residents in addition to dwelling enlargement.

However, there have been few attempts at housing renovation with dwelling enlargement work. This paper describes the actual conditions of dwelling enlargement works and recent technologies for regenerating and enlarging deteriorating public multi-unit residential buildings in Japan.

2. CASE STUDIES

Local authorities and public housing corporations in Japan started public housing regeneration and dwelling enlargement from the 1980s as mentioned above. Methods of dwelling enlargement have changed over time and according to the conditions, giving rise to a variety of dwelling enlargement methods and technologies. Typical methods are illustrated through the case studies presented below.

2.1 Dwelling Extension

Extension to the balcony side of buildings is the most frequent dwelling enlargement method in Japan (see Figures 1 and 2). The extension and the existing building connect via an opening where a glazed door was formerly situated. There is no need to make a new opening in the existing concrete wall, and existing interior finishings or functional systems are not generally repaired. However, this method is not suitable for buildings that are deteriorating. The extension is built of precast concrete panels or the like to enable quicker construction.

A bath unit or washroom is often located in the extension to supplement lacking function. A washroom and a washing machine space are located in the example shown in Figure 1 and 2.

Figure 1 Building Before and After Extension

Figure 2 One Pair of Dwelling Units Plans Before and After Extension

2.2 Rearrangement of Dwelling Units

Dwelling units are sometimes rearranged. The most familiar method of rearranging a dwelling unit is the connection of two units by making an opening in the partition wall as shown in Figure 3. Rearrangement of three units into two or four units into three by removing sections of partition walls and installing new partition walls is common. Such renovation often follows

drastic changes to the interior layout and relocation of installations, so that all the residents have to be temporarily rehoused in vacant units of other buildings during the renovation period.

The flats on the upper and lower sides are occasionally changed into a duplex (see Figure 4). In this five-story building, the 5th floor unit and the 4th floor unit were changed into a duplex. This change was made because many units on the 5th floor had been empty before renovation due to the tiring climb up the stairs to reach the 5th floor.

Figure 3 Dwelling Unit Plans Before and After Connection of Two Units

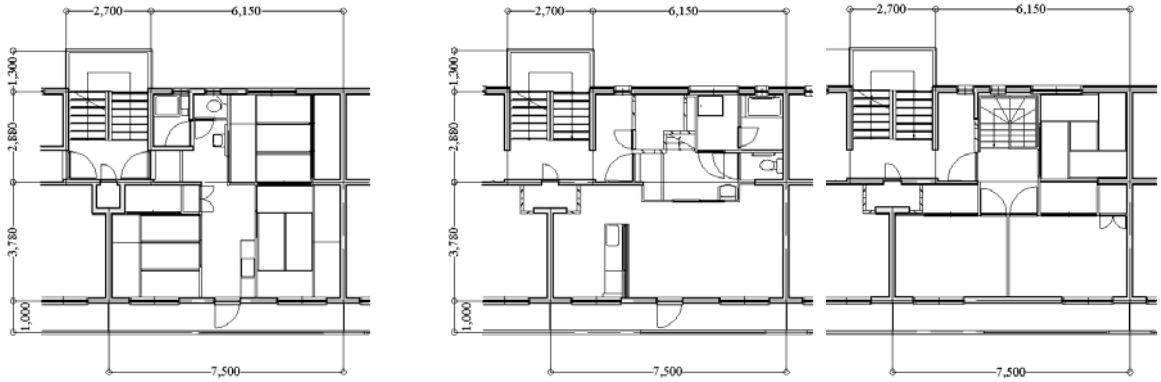

Figure 4 Dwelling Units Plans Before and After Flats into Duplex, Original Dwelling Unit Plan, Lower Floor Plan and Upper Floor Plan of Duplex

2.3 Elevator Addition

A great many of the aged public residential buildings only have stairway access even though they are four or five stories high. Estates that have a large number of elderly people urgently require the addition of elevators to make access more convenient.

One solution is the addition of an elevator tower to the stairwell of the building (see Figure 5). This method requires no repair to the existing building. However, it is necessary to add several elevators to one building, so that both initial and running costs accumulate. Moreover, this method does not achieve barrier free access to the dwelling as Figure 6 illustrates.

The alternative is to add access corridors and an elevator tower to the building (see Figure 7). This requires drastic change to the existing building skeleton and interior layout. Rearrangement of dwelling units is performed at the simultaneously in most cases.

Figure 5 Building Before and After Elevator Towers Addition

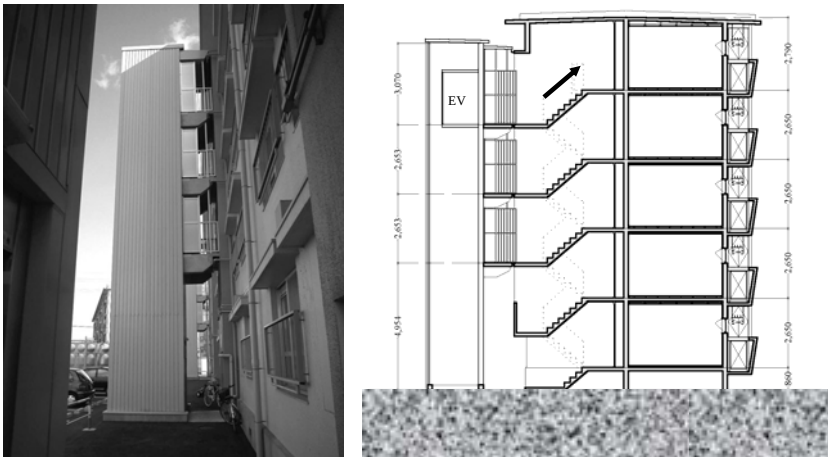

Figure 6 Building Section Showing Added Elevator Tower

Figure 7 Floor Plans Before and After Access Corridors and an Elevator Addition

3. RESULTS OF DWELLING ENLARGEMENT

This chapter considers the results of dwelling enlargement work and its transition. We conducted a questionnaire survey of all Prefectural governments and a city designated by ordinance in Japan, as well as the Urban Development Corporation, which is the biggest public housing corporation (60 bodies altogether). The response rate was 93.3% (56 / 60).

3.1 Survey Results

The survey focused on the following methods: dwelling extension, connection of two units, rearrangement of three units into two units, other dwelling enlargement methods, and the addition of access corridors and elevator towers. Figure 8 indicates each total of recreated dwelling units. This figure shows that dwelling extension is the most common method in Japan, and the next common is the connection of two units. The total number of access corridor added units does not include the number of simultaneous enlarged units. The number of access corridors added and enlarged units would be much greater much more. A total of 1,238,680 units are managed by these bodies, and the sum of recreated units accounts for 8.93% (110,655 / 1,238,680).

Figure 9 indicates how many bodies conducted each method. As many as 68% (two thirds) conducted connection of two units, 43% rearranged three units into two units, and 50% extended dwellings. Only 7% added new access corridors.

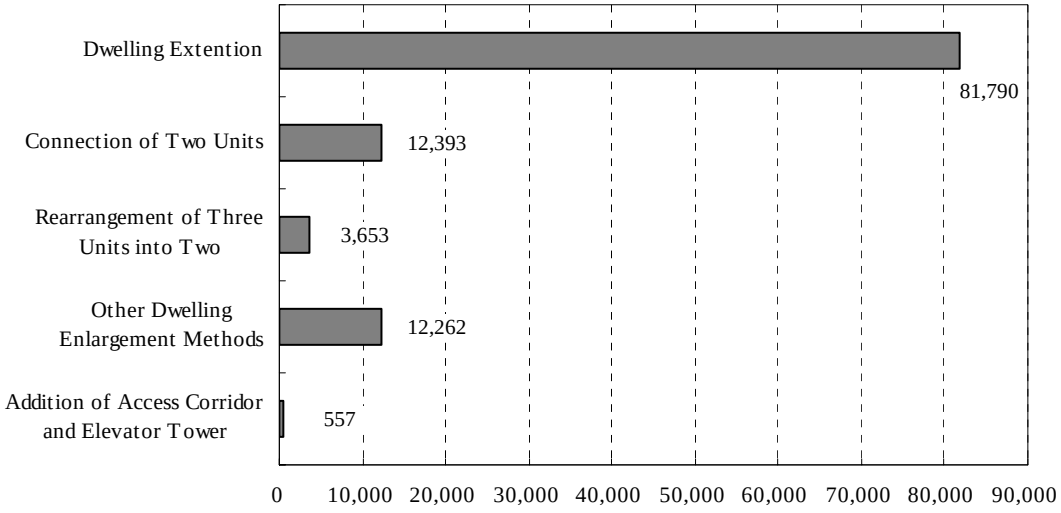

Figure 8 Total of Recreated Units in Japan

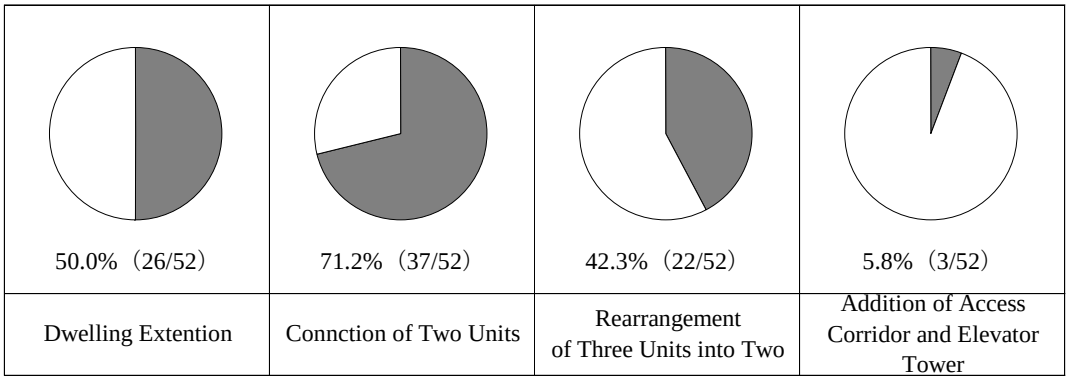

Figure 9 Rate of Bodies Who Have Conducted Housing Regeneration

3.2 Transition

Table 1 indicates the number of recreated units transition. The total is decreasing; on the other hand, access corridor addition is slightly increasing. This trend may continue with the increase in the number of elderly people.

Rearrangement of four units into three or six units into five began in the latter 1990s. This was due to the target unit transition from much smaller units to comparatively larger units.

The renovation methods revealed through the questionnaire show that multiply methods were applied to a building, and that different types of dwelling unit have been recreated in recent years in contrast to previous renovations when identical units were recreated in large quantities within a building or an estate.

Table 1 Number of Recreated Units Transition

Period \ Method	Dwelling Extention	Connection of Two Units	Rearrangement of Three Units into Two	Other Dwelling Enlargement Methods	Addition of Access Corridor and EV Tower
-1984	21,118	3,212	1,052	3,078	41
1985-1989	24,825	4,210	618	4,268	75
1990-1994	18,043	3,688	990	4,006	160
1995-1999	14,270	1,138	658	894	191
2000-	3,534	133	239	124	90

4. MOTIVES AND PROBLEMS

Below we explain the motives for renovation and problems in renovation obtained from a hearing survey regarding 14 renovation projects on the six housing supply bodies. Table 2 presents an outline of the projects and housing supply bodies.

Table 2 Outline of the Surveyed Projects and Housing Supply Bodies

Body (Geographical or Social Condition of Location)	Year of Construction	Year of Renovation	Method	
			Dwelling Enlargement	Elevator Addition
A (Cold District)	1973	2001	Four Units into Three	Access Corridors and EV Addition
	1977	2001	Six Units into Five	Access Corridors and EV Addition
B (Cold District)	1967	2002	Connection of Two Units	-
	1973	2002	Connection of Two Units and Flats into Duplex	-
	1973	2002	Three Units into Two	Access Corridors and EV Addition
C (Rural Areas)	1971	2000	Connection of Two Units	Addition of EV Towers to Stairways
D (Urban Areas)	1969	1999	Connection of Two Units	-
	1963	2001	Three Units into Two	-
	1961	2001	Dwelling Extension	-
E (Urban Areas)	1964	1997	Connection of Two Units	-
	1965	1997	Dwelling Extension	-
	1973	2000	Dwelling Extension	-
F (Urban Areas)	1966	1999～	(Interior Refurbishment on a One-Unit-at-a-Time)	-
	1978	1999～	(Interior Refurbishment on a One-Unit-at-a-Time)	-

4.1 Motives for Renovation

Figure 10 illustrates the motives for renovation. The motives fall into three categories: physical aging, deterioration in building capability and change in housing needs.

The most common in the physical aging category is the damage to reinforced concrete external walls through long exposure to the weather. Damages mean the cracks and exfoliations in the concrete, which are significant problem buildings older than 30 years. Damage interior finishings or plumbing was also a common motivation.

Improvement of insulation capability is the most common motivation in the building capability category. Insulation technology was not highly developed in the mass-housing era, so that the aged buildings in cold districts were uncomfortable. Furthermore, lack of insulation often causes condensation, which damages interior finishings.

In the change in housing needs category, barrier removal and customization for elderly people were the motivation in all cases in which interior finishings were renovated.

Renovation into various types of dwelling unit was the motivation in buildings whose units were rearranged. The residents of these estates are differentiating into young and elderly people because of the small, uniform dwelling units. The renovations were aimed at activating the estate community by attracting other age groups.

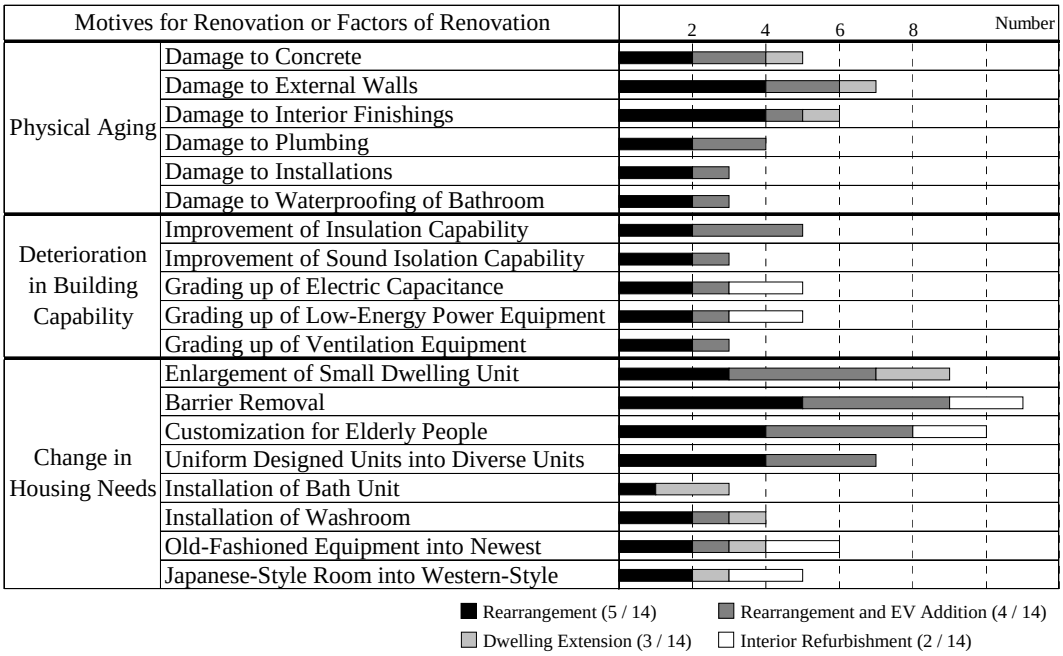

Figure 10 Motives for Renovation

4.2 Problems in Renovation

Figure 11 illustrates the problems in renovation design.

Buildings built in the mass-housing era are generally low in story height, about 2,600 mm, which restricts plumbing layout. Moreover, buildings have many bearing reinforced concrete partitions, which restrict the flexibility of interior layouts in renovation design when interior finishings were renovated, and this is a common problem.

There is barely any problem in cases in which existing interior finishings is left, for example dwelling added building. On the other hand, adding extensions to buildings requires a wide-open space. Extensions were not added for lack of wide-open space in some of the surveyed projects.

When renovating vacant units one-unit-at-a-time, possible renovation options are limited.

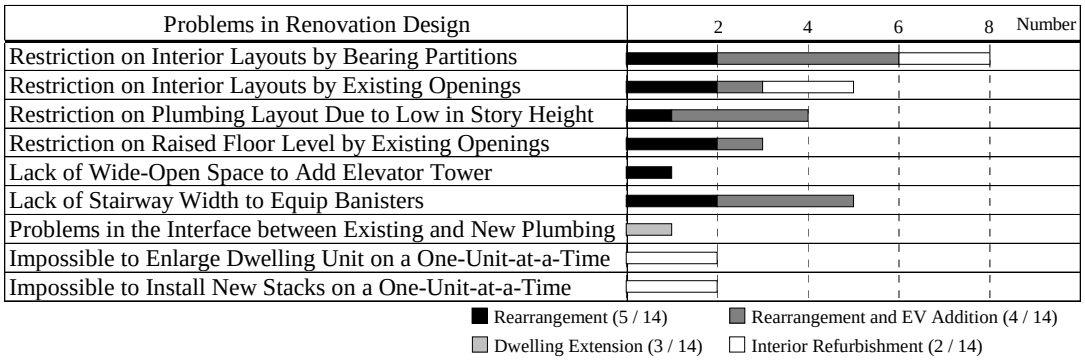

Figure 11 Problems in Renovation Design

Figure 12 illustrates the problems in renovation work.

Problems concerning imprecise existing building skeleton were common. Imprecision of the building skeleton generally becomes apparent after removing the existing interior finishings. This causes frequent modification of working drawings, and impinges upon the term of work.

The structure of buildings built in the mass-housing era is generally the bearing wall system, and it is troublesome to make sleeves for ducting in the beams or to make an opening in the partition walls to connect units.

Noise and concrete dust during renovation work were significant problems while renovating vacant units one-unit-at-a-time. The dwelling unit plan was designed with the intention of reducing work involving scraping concrete.

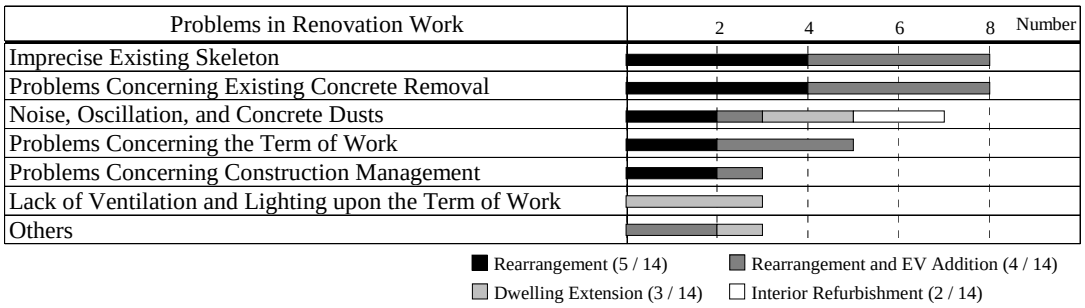

Figure 12 Problems in Renovation Works

5. CONCLUSION

We described the situation of renovating deteriorating residential buildings in Japan. The word "mass-housing" is used as a synonym for uniformity, and the residential buildings were renovated in standard ways in the past. However, the uniform design led to stagnation of communities with the change of housing needs. Recent renovation of declining housing estates is not only the renovation of housing qualities but also an attempt to increase diversity. Furthermore, some recent housing estates built in the mass-housing era appear to possess characteristics according to the locality in consideration of the local climate. They must enhance their individualities hereafter.

The renovation technologies for residential buildings are effective, although problems to be solved. However, what seems to be lacking now is an approach from the whole estate standpoint. A renovated estate obtains diversity, but renovated dwelling units are ordinarily only

part of the whole. It is necessary to develop a renovation method that is beneficial for all the residents, for example, a method of activating the common spaces on estates.

REFERENCE

Building and Equipment Life Cycle Association (BELCA). 2003. *Case Report of Public Multi-unit Residential Building Regeneration*, Tokyo: Building and Equipment Life Cycle Association.

* The drawings of the residential buildings in this paper were reprinted from the above report.

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