

# ACTUAL CONDITIONS OF ELEVATORS ADDITION TO THE AGED PUBLIC HOUSING IN JAPAN AND A PROPOSAL OF AN ALTERNATIVE METHOD

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## Summary

In Japan, a huge volume of public housing was built in the mass-housing era, and since this time, many problems have arisen in recent years. While much of the renovation work took place from the 1980's onwards, the methods of renovation work changed alongside changing housing needs. Today, due to an increase in the number of aged residents, one of the most significant pending solutions concerning public residential buildings is barrier removal and customization for elderly people. To solve this problem, several local authorities and public housing corporations have added new elevator towers or still further, access corridors to the buildings. However, certain problems still remain. This paper analyzes current circumstances, evaluating the present means of adding elevators, and proposes an alternative method.

## 1. Introduction

In Japan, there is a huge volume of relatively dated public housing built in the mass-housing era between 1955 and 1973. Some 30~40 years after construction, recent years have seen many problems arise, including: physical aging of the building, deterioration of installations and changing housing needs, for example. With such problems in mind, local authorities and public housing corporations in Japan started public housing regeneration and dwelling enlargement work from the 1980's onwards. Consequently, almost 10% of all public residential buildings were recreated using some typical renovation methods. These included dwelling extensions, merging two units, rearranging three units into two, etc.

In recent years, due to an increase in the number of aged residents, the need for barrier removal and customization for elderly people has been rising. Although the total volume of renovation work in public residential buildings is currently on a downward trend, there is still a gradual increase in the number of elevator towers and access corridors being added, and this trend is set to climb as the situation intensifies.

In the current context, however, the volume of renovation work involving additional elevator installation remains modest. Moreover, existing methods used to add elevators involve certain problems, and it is unlikely for these methods to have potential to prevail. The current paper aims to highlight the actual circumstances concerning the present methods used to add elevators, and to propose a new method that solves the existing problems and adds new attractions to housing estates.

## 2. Actual Circumstances Concerning Addition of Elevators

Many housing estates with numerous aged residents urgently require the addition of elevators to facilitate access. To solve this problem, several local authorities and housing corporations have added new elevator towers or, still further, access corridors to the buildings. This chapter analyzes some public residential buildings to which elevators have been added, and classified them according to the means of renovation employed.

## 2.1 Renovation Work involving the addition of an Elevator Tower

The addition of an elevator tower to the outside of each of the staircases in the building is the most frequent example of adding an elevator. This method is easy to construct, since there is no requirement to repair the existing building. However, this method does not result in totally barrier free access to the dwellings. The elevator car has to stop at the landings of the stairways, meaning residents have to go up or down half a story in height on foot (see figure 3).<sup>13</sup>



Figure 1 Building before and after the renovation work involving the addition of elevator towers

## 2.2 Typical Method

Some alternative methods of adding elevators have been proposed and implemented to achieve barrier free access to the dwellings. Figure 2 classifies the typical methods used. This diagram was described referring to Miki 2004.

The most popular alternative method involves adding access corridors to the building; namely adding access corridors for each floor from the 2nd onwards, and setting up a single elevator tower adjacent to the corridors or within the staircase by removing the existing steps (see method 4 of the following diagram). The other potential methods for adding an elevator involve: adding elevator towers to the outside of each staircase of the building by changing the existing half-turn stairs into straight stairs (method 2 on the diagram), and adding elevator towers to the outside of each of the building's staircases with the entrance porch linked to each dwelling (method 3 on the diagram).

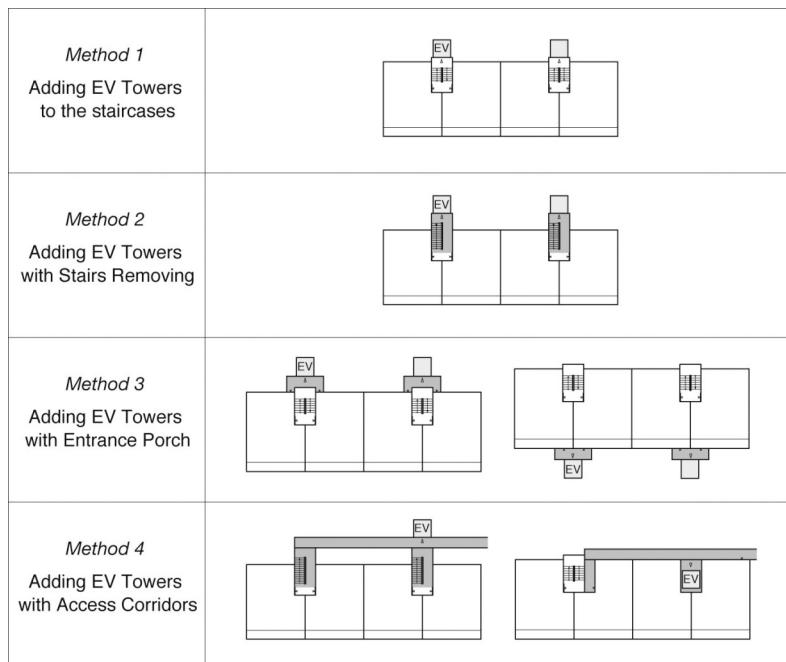


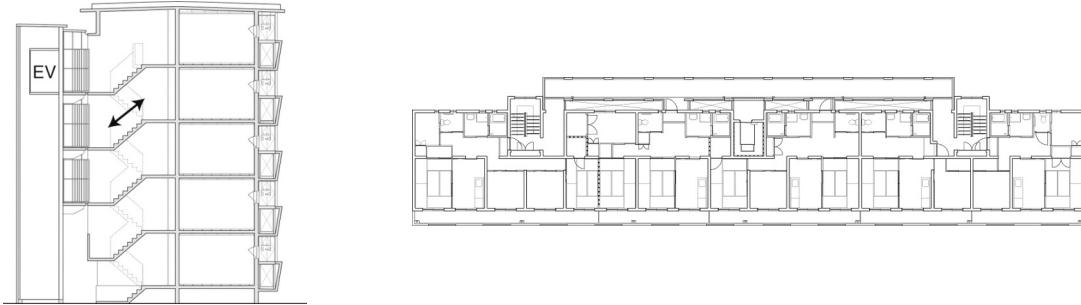
Figure 2 Four typical methods of adding an elevator

## 2.3 Problems in Elevator Addition

Although renovation work to add elevators has been conducted using some of the typical aforementioned methods, certain problems still remain. For example, the method involving the addition of EV towers to the staircase (method 1 on the diagram), does not result in completely barrier free access as mentioned above.

Meanwhile, if a method involving the addition of EV towers and the removal of stairs is employed (method 2 on the diagram), there are few buildings with wide enough staircases to change the stairs and add new landings. Finally, methods involving the addition of EV towers with an entrance porch and those involving the addition of access corridors (methods 3 and 4 of the diagram) both require drastic changes to the existing building skeleton and interior layouts. This will, in turn, result in longer term of renovation work and a higher cost.

Therefore, all have respective problems and remain predominantly negative solutions.



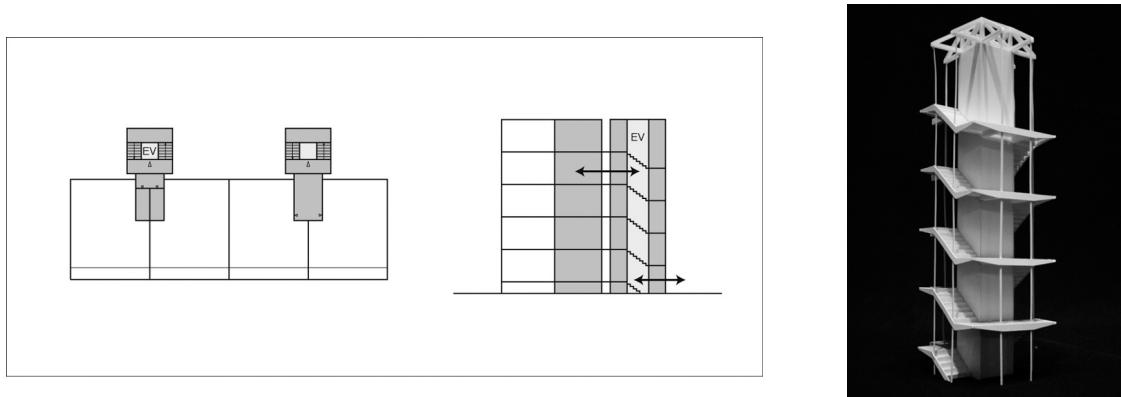
*Figure 3 Section of building to which elevator tower is added for method 1 and plan view of method 4*

### 3. Alternative Method Proposed

The present methods used to add elevators are associated with certain problems and there is no standard method. Therefore, a new alternative method achieving barrier free access and facilitating more economical renovation work is required. Moreover, the addition to the building must represent an asset. The current chapter proposes such a new alternative method.

#### 3.1 Concept and Outline

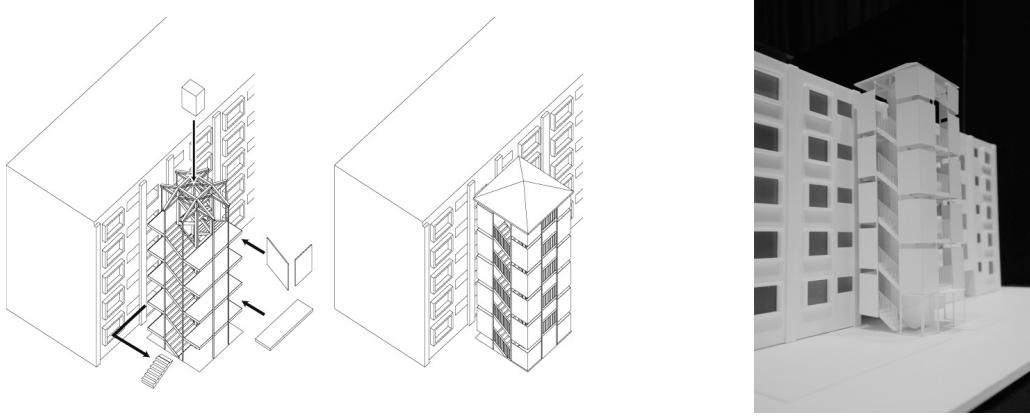
The alternative we propose is an elevator tower unit consisting of an elevator shaft and stairs installed in a spiral design encircling the shaft. The system of constructing this tower unit in relation to the building is very simple. Firstly, this tower unit should be installed on the outside of the existing staircase and the existing stairs should be removed. Next, new floors should be installed in the vacant stairwell on each floor level, and the tower unit connected with these new floors. This method will enable barrier free access to the dwellings with using a dual open system elevator, shown in the cross-section in the following diagram.



*Figure 4 Concept diagrams of new alternative method, and its structural model*

#### 3.2 Structural Idea

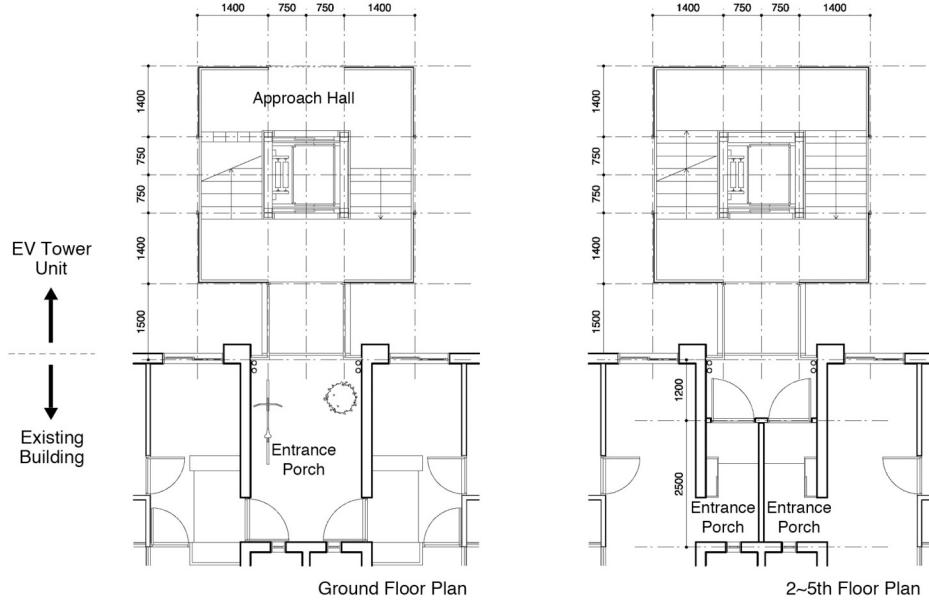
This elevator tower unit requires a compact elevator. However, since the steel frame in the shaft is the main structure of this unit, minimizing the elevator dimensions results in structural weakness in terms of horizontal force. This is a recurring problem during renovation work to add elevator towers. We solved it with the use of a slender tension rod around the elevator shaft (see the structural model on the right of figure 4). This idea is useful for not only structural enforcement purposes but also for generating a lighter impression of the elevator tower unit.



*Figure 5 System diagram and configuration of building following addition of elevator tower unit*

### 3.3 New Attractions

The elevator tower unit generates two new spaces for residents. The first is a new approach hall for all residents, generated at ground level within the unit. This hall allows independence within an enclosed common area and consists of an elevator hall and a space for mailboxes. The other is a new entrance porch for each dwelling and these areas are freed up on the additional floors in the stairwell. This space will be utilized as common external space for the two dwellings located at both sides of the stairwell, or interior private spaces for both dwellings after being divided in half.



*Figure 6 Partial plan of the building stairwell following addition of elevator tower unit*

## 4. Case Study

We study an application of the new method to actual public housing for planning purposes in more detail and verify the resultant effects.

### 4.1 Site

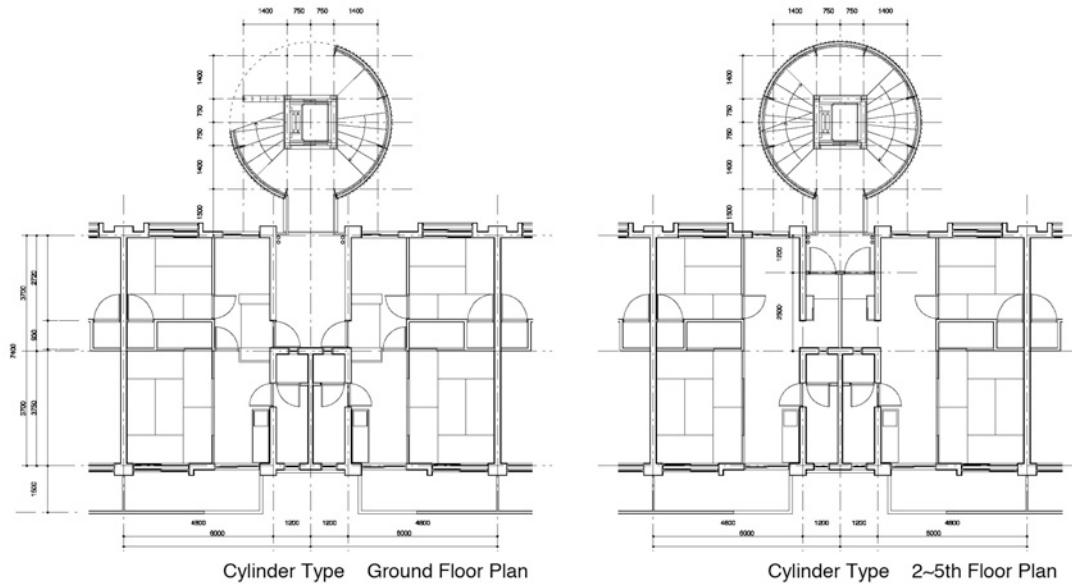
As the chosen site for applying this method, the 'N' housing estate, including a typical selection of aged residential buildings was selected. This housing estate is located within a tranquil Tokyo housing district and just like many other aged Japanese housing estates, the open lawn spaces are relatively wide and the trees flourish. However, the buildings are physically old and the installations outdated and in decline, problems common to many other aged housing estates in Japan. The sample building to which the elevator tower unit would be added was five stories high, with particularly small dwellings.



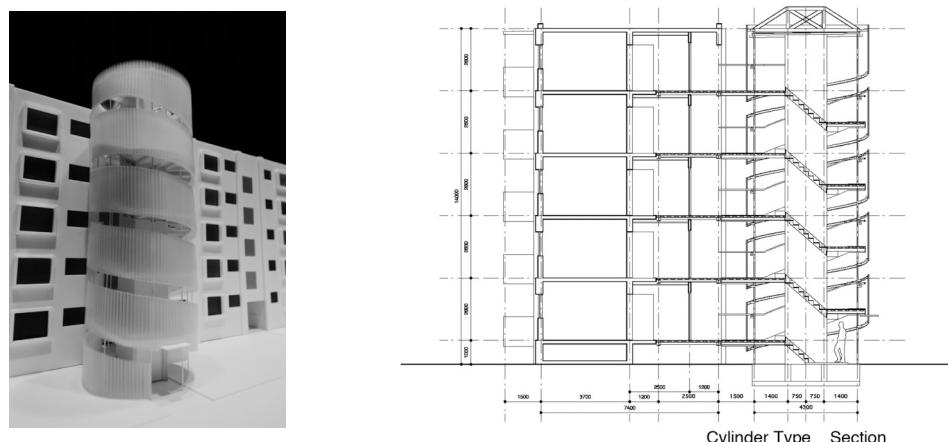
*Figure 7 Building and surroundings of the 'N' housing estate in Tokyo*

#### 4.2 Variation and Its Features

We conducted various studies concerning this method, especially the surface design, based on the specified planning features. Consequently, the surface design of the elevator tower unit was divisible into two types. The most basic type that could be explained in chapter 3 was the "Square Type". This consisted of simple rectangular stairs and included the potential to arrange its surface to fit the surroundings. The "Cylinder type" meanwhile is another variety with a circular plan and a softly curved translucent surface. This type represents simultaneously sharp and soft forms of existence in contrast to the uniformity and vastness of the housing estate.



*Figure 8 Partial plan of the building stairwell to which a "Cylinder type" elevator tower unit has been added*



*Figure 9 Configuration of building added "Cylinder type" elevator tower unit, and its section*

The approach hall of this elevator tower unit becomes a new gate to the dwellings, illuminated for safety, and the tower lighting also provides soft illumination for its surroundings at the same time at night.



*Figure 10 Additional elevator tower unit fitted to building lights up the surrounding area at night*

## 5. Conclusion

Through various means of examination concerning the renovation work of the addition of an elevator to the public residential building, the possibilities of the new method have become clear: achieving barrier free access and facilitating renovation work is possible due to the simplicity of the method used for this system. Moreover, it also means the creation of new and attractive spaces at the same time. Although this method requires a slight change to the existing building skeleton, the construction only requires residents to vacate homes for a minimal time, due to the increased speed of construction.

Hereafter, it is necessary to examine the details of construction system, in terms of cost and legal background. Furthermore, the means of smooth residents' agreement on housing renovation must also be discussed.

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## References

- Research Committee on the Public Housing Regeneration (Fukao, S., Kadowaki, K. et al.), Building and Equipment Life Cycle Association (BELCA), Case Report of Public Multi-unit Residential Building Regeneration, Building and Equipment Life Cycle Association, Tokyo, Japan
- Kadowaki, K., Fukao, S. & Arahira, T 2003, Regeneration with Dwelling Unit Enlargement of Public Housing in Japan, Proceedings of the Conference of CIB W104 Open Building Implementation "Dense Living Urban Structures", pp. 267-275, The University of Hong Kong, Hong Kong
- Tsuji, T., Fujita, S 2004, A Study on the Elevator Installation in a Existing Public Lease Apartment –Focus on the stairs room type elevator-, Journal of Architecture and Planning, 6, pp.161-168, A.I.J., Tokyo, Japan
- Miki, T. 2004, "Barrier Free" Renovation of Housing Complex's Common Space, Kenchikuchishiki, 4, pp. 91-93, Xknowledge, Japan