Mix-strata Housing Plan through Vertical Extension Remodeling for Aged Apartments

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Abstract A large number of apartments in the 1st phase new towns that were built in the vicinity of Seoul during the 1990s are now facing problems associated with aging. To solve this issue of deterioration, the Korean government has encouraged remodeling, in particular allowing general sales for housing where vertical extensions have been added through remodeling. In this study, a mix-strata housing plan through vertical extension remodeling has been proposed for aged apartments in Korea’s Bundang new town, with a focus on public transportation. By considering a previous study, various floor plans which cater to the specific characteristics of the residents—including single household, elderly couples, newlyweds, and the young generation—have been examined in this study, and how these residents would be able to form a community with existing residents has been suggested. The authors hope that the results of this study would not only resolve the physical deterioration of aged apartment complexes in TOD areas but also establish a new form of remodeling that retains new social sustainability.

1. Introduction
In April 1989, the Korean government developed 5 new towns of Bundang, Ilsan, Pyeongchon, Sanbon, and Jungdung, to stabilize housing prices and alleviate housing shortages in the capital region. These new towns are situated within 20 km from Seoul and were naturally planned with a focus on public transportation due to the consideration of accessibility to Seoul. However, the new towns developed then have brought the deterioration of housing into question as 30 or so years have passed. Since many of the apartments were built during the early and mid-1990s, the rate of aged apartments is rising rapidly, with 73.0% of all housing in the 1st phase new towns found to be over 25 years old. In particular, since Bundang’s new town consists of a high-density residential area with a cluster of apartments, this suggests the need for apartment remodeling. The Korean government encourages remodeling of aged apartments—whereby houses can be fixed and reused—and is gradually relaxing policies related to remodeling. It has not only legally allowed existing apartments to be vertically expanded, but has also permitted 2-3 floors to be built on top of the existing buildings so that new housing units could be put for sale.

Meanwhile, Korea’s household composition has moved from past tendencies characterized by a large share of 4-5 person households to an increasing share of single and 2-person households in recent periods.
Housing supply for these households is much needed in the market, with a gradual increase in the demand for small-size areas of less than 40 m². A previous study (Choi et al., 2018), by reflecting such demands, suggested small-size housing plans for vertical extensions.

In this context, this study hopes to employ the findings of the previous study, thereby, suggesting a mix-strata housing plan through vertical extension remodeling of aged apartments. It hopes to propose a type of apartment remodeling wherein residents with diverse characteristics live together—with an influx of new households in vertically extended areas through remodeling.

![Figure 1. The 1st Phase New Towns (Top)](image1)

Figure 2. The Rate of Old Houses in the 1st Phase New Towns (Bottom)

The method of this study is as follows. After reviewing the existing vertical extension remodeling design, we proposed the Mix Strata Housing that can be combined with the detailed unit plan and various age groups. We proposed a scenario for the main unit Mix Strata Housing community and compared the physical differences and social influences between the existing remodeling method and Mix Strata Housing.

2. Literature Review
We reviewed previous studies related to apartment remodeling and Mix Strata housing. Sung (2013) proposed a plan for one-person households for urban-type housing, but it was a unit plan rather than the main unit plan. Chun (2016) proposed a separated generation plan, but it can be applied to only some layers. Choi et al (2018) proposed a small-size housing plan for the vertical extension. It is meaningful in that it expands the choice of residents, but there is a lack of scenarios on how existing and new residents will live in the building, and how the individual small-size housing plan can be used specifically. Based on the research of Choi et al (2018), this study proposes a concrete scenario for Mix-Strata Housing through apartment remodeling, and also suggests how individual floor plans can satisfy various residents.

3. Small-size housing plan for vertical extensions

3.1. Key Considerations
Vertical extension remodeling, which is the subject of this study, is a remodeling method introduced to improve the residential environment of aging apartments through vitalization of remodeling projects and to reduce the project cost of residents. This was made possible by the 2014 amendment to the Housing
Act in Korea. Previously, when remodeling an apartment, the number of units could be increased only by dividing horizontally or building a separate building, or dividing one existing unit. The amendment to the Housing Act of 2014 allows for a vertical extension of up to three floors for apartments over 15 floors and two floors for apartments below 14 floors. The growth rate of units also eased from 10% to 15%. Since the amendment, research to realize this has been conducted in various ways.

![Figure 3. Vertical Extension by Remodeling](Author, 2018)

In this study, among the vertical extension remodeling, a small-size housing plan has been applied as suggested by the previous study (Choi et al., 2018), because it is believed that in consideration of the potential demands for vertical extensions, a small-size housing plan would be more advantageous than maintaining the existing area plans or integrating units. In the previous study, an applicable target was designated, primarily considering aspects of architectural planning, resident characteristics, structures, and facilities before producing a small-size housing plan.

3.2. Study Target
Bundang's new town, as with the other 1st phase new towns, was designed to be connected to Seoul via the rapid transit and metropolitan bus system. As a result, living zones were planned so that residential and convenient facilities were to be clustered within 500 m from metro stations, while high-density residential areas were to be developed on the outside. While the early formative period of the 1st phase new towns, including Bundang, saw a prominent influx of young adults and middle-aged people aged 35-49 years with their children aged 15 years or younger, the aging of the towns has led to a steadily reduced population flow of young adults and middle-aged people. This indicates that despite the changes in the life cycles of the residents, they tend to stay in the same residential types as those of the past, while at the same time, there is still availability of residential environments that the young classes prefer. Thus, providing a suitable residential type would attract these people.
Mujigae Maeul Complex 4 was designated as a case for the generation of the small-sized housing plan in the previous study because of the ease of data collection and the representativeness of the residential unit within the target area. It is located at the center of the residential area, thus, not leaning on one geographical side within the complex residential area. Further, when it comes to the residential apartment units, the 85 m² floor plan of Mujigae Maeul Complex 4 is similar to that of the top representative type of the aged apartments in the 1st phase of new towns (Choi et al., 2016). Since it means that this type of apartment has the largest share of the target residential units in the 1st phase new towns, it can serve as a suitable target subject in this study, which seeks to examine mix-strata housing in the 1st phase new towns.
The remodeling plan of the target subject in the previous study was generated with key consideration of the realistic aspects including space utilization of the existing floor plan and structure/facilities. As a result, one building was organized into 6 units, retaining the number of units, while changing the core type from corridor-type to stair-type. The existing core was used for the central core of the main building, thus, improving its economic efficiency. Its area increased from 58 m² to 69 m² in reflecting Korea’s remodeling policies, while the frontal bay width was kept at 3,160 mm to maintain the bearing wall as much as possible. In terms of the interior composition of the unit, the structural and facilities aspects, such as the location of the bearing wall, were primarily considered, enhancing practicality. Besides, lighting was also taken into account, so that rooms without the need for natural light were placed in the center, and bedrooms were placed in the outer section in consideration of the living conditions. Further, ancillary rooms such as the dressing room, living room, bathroom, and multi-purpose room were added while maintaining the same number of bedrooms, thus, reflecting the changes in the lifestyle and the residents’ preferences.

4. Study Results

4.1. Mix-strata Housing

In the previous study, the floor area of the remodeled main building was planned by dividing it into a general unit and combined unit compositions. The general unit composition reflected the bay-type of existing units, in which 2 units were designed as 4. This composition has the advantage of utilizing adjacent households as household-specific residences and maintaining the structure of the existing bearing wall, thus, eliminating the need to apply additional structures. However, the deeper slenderness makes it difficult for natural ventilation to be rendered for units located in front of the staircase. The combined unit (C-F of the floor plan after remodeling) is composed of floor types of 3-4 different characteristics each. As the unit is separated into front and back, alighting or ventilation issues could arise; these limitations could be overcome by building a courtyard in the center of the main building. Since the combined unit composition has a variety of floor plan types and areas whose floor types of different characteristics could be applied while catering to the characteristics and lifestyles of various residents, this study has been developed by solely targeting the combined unit.

![Before remodeling](image1.png)  ![After remodeling](image2.png)

Figure 7. Small-sized housing plan (Source: Choi et al., 2018)

The floor type of the combined unit, as observed from the residents’ characteristics, can be classified into 3 types: A, B, and C, as shown in Table 1.

Type A (area of exclusive use: 43.44 m²) is a small-sized housing type with a 2-Bay type plan,
applicable to 1-2 person households. It is composed of a living room and 2 bedrooms, of which 1 room can be used as a living room and the other remaining supplementary bedroom can be used as a study, working space, or child’s room. The bedroom and part of the bedroom face south, while a courtyard facilitates the provision of lighting and ventilation in the bedrooms and the living room.

Type B (area of exclusive use: 67.58 m²) has a 3-Bay type plan, composed of a living room and 2 bedrooms, while in fact, all the rooms are arranged in a southward direction. The bedroom, located at the innermost part of the house, can guarantee a convenient lifestyle and privacy for the couple if a dressing room and a bathroom are added. A pantry can be placed adjacent to the kitchen, to be used as a storage space. Further, the side bathroom can be used for a different purpose, as with Type A. This plan is suitable for newlyweds or elderly couples who experience a wide range of home activities and spend a lot of time at home during the day.

Type C (area of exclusive use: 16.91 m²) has a 1.5-bay type plan, designed as a studio-type floor plan for young adults or single households. Since young adults tend to stay at home during the nighttime more than during the day, a northward layout that obstructs adequate natural light can be applied. Further, since the house tends to be occupied by a single occupant, a floor type that combines the living room and the bedroom can be applied rather than that which separates the two, to achieve space efficiency.

| Type | TYPE A | TYPE B | TYPE C |
|------|--------|--------|--------|
| Floor plan | ![TYPE A Floor Plan](image) | ![TYPE B Floor Plan](image) | ![TYPE C Floor Plan](image) |
| Description | • 2-Bay Type Unit.  
• Lighting and ventilation improvement through the courtyard.  
• The bedroom adjacent to the courtyard can be used as an office. | • Front 3-Bay Type Unit.  
• Southward layout for living room and two bedrooms.  
• Dressing room, couple’s bathroom, and pantry are included. | • Studio 1-Bay Type Unit for young adults and single households.  
• Northward layout for young adults who spend most of the times at home during nighttime. |
| Key targets | Single, 2-person households | Newlyweds, elderly couples | Young adults, single households |

4.2. Community Scenario

The small-sized housing plans of the vertical extension have been proposed in sync with the living characteristics of various residents including 1-2 person households, elderly couples, newlyweds, and young generations. As such, the various types of residents that would move in—centered around 1-2 person households—would form a new community with the existing 3-4-person family households. The specific community scenario of an apartment complex that has been remodeled through vertical extension—to estimate the kind of residential environment that can be formed by the coexistence of existing residents and new tenants—is as follows.

Mix-strata housing will provide a lively community within the apartment complex by serving as a social connection point between various residents. If a young couple from an existing 3-4 person household living in an existing floor needs a domestic worker who can assist in doing household chores or a babysitter who could look after the young child, an elderly couple household who have moved into the vertical extension floor of the main building could help by fulfilling that role. The children of a...
family unit household living in the existing floor could also receive tutoring from a young adult occupant who has moved into the extended floor. Further, existing elderly occupants who wish to keep their old residential environment without the need of owning a large floor area, or existing elderly and middle-aged residents who seek independence from their young children can move to a small floor type in the same building or within the complex, and be able to continue living their separate lifestyles within a close living radius of their children.

Figure 8. Aged Apartments Community Scenario Diagram

The mix-strata housing plan through vertical extension remodeling, as suggested in this study, would be able to generate a community platform that can satisfy the mutual needs of various types of residents who live in densely populated cities, while at the same time serving as a new type of remodeling that provides energy and social sustainability in the new community.

5. Discussion
The Mix-strata Housing has physical properties that are different from the existing horizontal and vertical remodeling methods. Table 2 compares these differences by focusing on community development and housing demand based on social background.

One of the major differences caused by the physical differences between the three types is their relationship to the surroundings.

The existing horizontal extension remodeling method increases the number of units by horizontally expanding the building or constructing a new building, thus changing the way existing apartments relate to the surroundings. However, the existing vertical extension remodeling method and the mix-strata housing through vertical extension remodeling extend only vertically and do not significantly change the existing context. Not changing the residential environment created over time would be an advantage for residents.

The horizontal extension remodeling and the vertical extension remodeling will show differences in the economic aspects of the remodeling business. The horizontal extension remodeling may have limitations because it requires the purchase of additional sites, but the vertical extension remodeling only costs money for structural reinforcement and does not require the expansion of apartment complexes and relatively low cost.
Another difference from the social aspect is the community development between new residents and the existing residents. The existing horizontal extension remodeling method has the possibility that the new types of residents, such as 1,2-person households, will flow in, depending on the flat type of the plan of the extension unit. However, it is difficult to develop a community, if new buildings are built and new residents are gathered in their buildings. The existing vertical extension remodeling adds units with the same unit plan as the existing units, and it is highly likely that the inflow of new residents which are similar characteristics to the existing residents will have occurred. This does not reflect the housing demand of the younger population, which may accelerate the aging of the housing. The mix-strata housing through vertical extension remodeling, on the other hand, has the advantage of being able to meet the housing demand of the younger generation by dividing the existing unit into smaller units and to develop a community with the existing residents by sharing the common space in the building.

### Table 2. Feature Comparison by Remodeling Type

| Type                  | The Existing Remodeling Method through Horizontal Extension | The Existing Remodeling Method through Vertical Extension | The Mix-strata Housing through Vertical Extension Remodeling |
|-----------------------|------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------|
| Relationship to the Surroundings | Changes in interaction with the surroundings due to the horizontal expansion of buildings or changes in the number of buildings | Relationship with the surroundings remains unchanged because it expands only vertically | Relationship with the surroundings remains unchanged because it expands only vertically |
| Economic Effects     | • Available for general sale, as the number of units increases  
• Need additional land purchase | • Available for general sale, as the number of units increases  
• Cost needs for structural reinforcement | • Available for general sale, as the number of units increases  
• Cost needs for structural reinforcement |
| The inflow of New Residents | • New types of residents can come in, depending on the plan type of extension units | • The inflow of residents who have similar characteristics to the existing residents | • The inflow of residents who have different characteristics with the existing residents |
| Community Development | • In the case of building a separate building, it is difficult to develop a common community between existing and new residents. | • Accelerating aging of residential areas because it cannot reflect the housing demand of the young population | • Meeting the residential demand of young population such as 1,2-person households  
• Create synergy by developing new community with existing and new residents |

6. Conclusion

In this study, mix-strata housing through a vertical extension remodeling plan for aged apartments in Korea’s Bundang new town has been proposed, and the plan is in consideration of the public transportation system.

Utilizing a small-size housing plan for a vertical extension, which is the result of previous research (Choi et al., 2018), we suggested details of the plan according to the characteristics of various residents including single households, elderly couples, newlyweds, and young generations. We also proposed how new residents can form a community with existing residents to achieve Mix-Strata Housing. Also, the results were compared with not only the physical differences from the existing horizontal and vertical remodeling methods but also the social impacts on the residential areas. Besides, the results were
compared with not only the physical differences from the existing horizontal and vertical remodeling methods but also the social impacts on the residential areas.

It is hoped that the study results would not only solve the physical deterioration of aged apartment complexes located in TOD areas but would also give rise to a new type of remodeling that would maintain new social sustainability. It is anticipated that this study would assume significance as one method of maintaining density in central areas TOD-wise, and in providing affordable housing—as is much needed in the local community.

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References
[1] Choi J, Choi J and Kim Y 2018 A Study on Small Size Plans of Vertical Extension Remodeling for Aged Apartment Journal of The Architecture Institute of Korea Planning & Design 34(8) 3-11
[2] Choi J, Choi J and Jeong E 2018 Lessons from Remodeling Aged Apartment Units in First-generation New Towns around Seoul Open Building for Resilient Cities (Los Angeles) 2018 Aug
[3] Choi J, Choi J, and Park C 2016 Research on the Representative Types of Aged Apartments in the 1st-Phase New Town for Remodeling Journal of the Architectural Institute of Korea Planning & Design 32(4) 33-40
[4] Chun Y 2016 A Study on Divided Housing Remodeling For Apartment, Master Dissertation, Yonsei University
[5] Kim j 2019 Changes in Demographic Characteristics of the 1st New Towns Based on life Cycle Financial Group Research
[6] Kwon Y, Ko J, and Kang J 2014 Policy Development Guidelines on the Effect Estimation on Promoting Apartment Remodeling Policy in Seoul: Easement of the Height, Household, and FAR Controls The Seoul Institute Policy Research Report
[7] Seongnam-city 2015 Business plan of Rainbow Village 4 Complex ’Remodeling
[8] Sung L 2013 A Suggestion of 1~2 Person Household Unit Plan in Urban-Compact Housing for the Target Group Having New Lifestyle Journal of The Architecture Institute of Korea Planning & Design 29(7) 119-120