Study on the Living Space Planning in Ulaanbaatar, Mongolia Part 2
- Residential and Living Environments in Apartment Complexes -

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Abstract
This is Part 2 of our “Study on the Living Space Planning in Ulaanbaatar, Mongolia,” whose objective is to determine trends and characteristics in residential and living spaces of apartment complexes in urban parts of Ulaanbaatar, focusing on the relationship between the residential and living environments of apartment complexes in Ulaanbaatar and the lifestyle activities and attitudes of residents. Based on a questionnaire survey of residents and a survey of living spaces within a 500-meter radius of two apartment buildings with differing layouts, both located in urban parts of Ulaanbaatar, we determined the correlations between residents’ attitudes and their residential and living environments, as well as the conditions and characteristics of both apartment buildings. We also studied the need to plan living spaces in a way that is grounded in the intricate interrelationships among residents, activities, and spaces that are unique to Mongolia.

Keywords: Ulaanbaatar; living space; living environment; apartment complexes; attitudes of residents

1. Introduction
This is Part 2 of our “Study on the Living Space Planning in Ulaanbaatar, Mongolia,” whose objective is to determine trends and characteristics in residential and living spaces of apartment complexes in urban areas of Ulaanbaatar through a comparative study of activities and residential and living spaces at two apartment buildings with differing layouts, focusing on the relationship between the residential and living environments of apartment complexes in Ulaanbaatar and the lifestyle activities and attitudes of their residents. In Part 1,1) we analyzed the land use conditions (land-use classes) of the outdoor common spaces incidental to apartment buildings, and studied activities in common spaces through a comparison of two apartment buildings with differing layouts.

In this paper, we determine the conditions and characteristics of living spaces in apartment complexes located in urban parts of Ulaanbaatar by comparing the conditions of residential and living spaces of two apartment buildings with differing layouts in terms of the distribution of various types of facilities as well as a questionnaire survey of residents, focusing on the relationship between the residential and living environments of apartment complexes and the lifestyle attitudes of residents.

In Ulaanbaatar, master plans for urban development have been established since the 1950s. The content of these plans consisted primarily of apartment planning and development planning relating to industrial zones. Therefore, no land use plans and zoning plans were established, and in general discussions regarding various types of facility construction were held, and decisions made, on an individual basis. Currently, various laws have been established (the Land Law, the Urban Development Law, the Construction Law, the Housing Law and so on), but this does not mean that adequate residential district planning is always implemented.

Specific information regarding apartment districts in Ulaanbaatar was provided in Part 1 of this study 1). Formerly, in the center of Ulaanbaatar, there were many medium-rise brick apartment buildings constructed in the period up through the 1960s. In the northwestern part of the survey area, there are many high-rise apartment buildings constructed of precast concrete panels. There are six layout types for apartment

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buildings: parallel layout, courtyard enclosure layout, \( L \)-shaped layout, staggered layout, stand-alone tower layout and flat sheet layout. The four layouts apart from the flat sheet tower and sheet layouts generally have common spaces.

2. Objective of Study

In this paper, we conduct a comparative study of the locational characteristics of the apartment buildings surveyed by analyzing the surrounding environments of these buildings with a focus on the distribution, numbers, and densities of various types of facilities; and we determine the lifestyle attitudes and activities of residents by means of a questionnaire survey of apartment residents. The objective is to determine trends and characteristics in the residential and living environment of apartment buildings through a comparison of two apartment buildings with differing layouts, both located in urban parts of Ulaanbaatar, with regard to their residential and living environments, taking the perspective of the relationships among people, activities, and spaces, and based on verification of the locational characteristics of the apartment buildings surveyed, the lifestyle activities of residents, and their attitudes concerning the residential and living spaces.

3. Investigative and Analytical Methods

Facilities located within a 500-meter radius of two apartment buildings with differing layouts, the same ones surveyed in part 1, were classified as urban infrastructure facilities, production and distribution facilities, commercial and business facilities, health and welfare facilities, recreational facilities, religious facilities, educational, scientific, and information facilities, residential and lodging facilities, common facilities, and other facilities. To determine the characteristics of the surrounding environment of apartment buildings located in urban parts of Ulaanbaatar, we identified and compared the quantities, densities, and proportions of these facilities at 100-meter radius intervals, based on this classification. Next, we classified the spaces of the floor plans within the individual apartments as living rooms, kitchen/dining rooms, and sanitary rooms (bath and toilet), calculated the area of each room, and compared the area ratios of exclusive indoor spaces to common indoor spaces (within the residential buildings) to determine the respective characteristics of each building.

At the same time, based on a questionnaire survey of residents in each apartment building concerning their residential and living environments (conducted in August 2002), we determined the lifestyle attitudes and activities of the residents. This survey includes questions about the residents’ basic characteristics, reasons for living there, intent to reside permanently or move away, and opinions or level of participation concerning the residential and living environment and community activities. As in the case of Part 1, which was previously published, heads of households and their spouses were included in the questionnaire survey of apartment residents and their responses were subjected to data analysis.

Based on the above analyses, we determined correlations among the results of a questionnaire survey including the opinions of residents concerning their residential and living environment, floor plans of residential buildings and other aspects of living space, conditions of the surrounding environment, and facility distribution within a 500-meter radius of apartment buildings located in urban parts of Ulaanbaatar, in order to identify trends and characteristics of the residential and living environment in apartment buildings of differing layouts.

4. Overview of the Apartment Buildings Surveyed (Fig. 1)

As in Part 1, we surveyed two apartment buildings with differing layouts. More details about these apartment buildings can be found in Part 1.

5. Facility Distribution within a 500-meter Radius

Table 1 shows the distribution of facilities within a 500-meter radius of B.T.Z.-2 and S.K.U.-5.

Looking first at B.T.Z.-2, under the category of recreational facilities, there is a dense concentration of recreation facilities and entertainment facilities within a 0 to 100-meter radius. Under health and welfare facilities, there is a dense concentration of hospitals within a 0 to 200-meter radius. There is a dense concentration of housing and apartments within a 0 to 100-meter radius. There is a dense concentration of schools within a 0 to 300-meter radius. Under S.K.U.-5, under the category of commercial and business facilities, there is a dense concentration of stores and sales facilities, other commercial and business facilities, and financial facilities.
institutions within a radius of 0 to 100 meters, 0 to 200 meters, 0 to 300 meters, 0 to 400 meters, and 0 to 500 meters. Under recreation facilities, there is a dense concentration of eating and drinking establishments and entertainment facilities within a radius of 0 to 100 meters, 0 to 200 meters, 0 to 300 meters, and 0 to 400 meters. There is also a dense concentration of housing and apartments in areas outside a radius of 0 to 200 meters.

These findings are exemplified by the locational characteristics of each building, considering that S.K.U.-5 is next to a busy shopping street while B.T.Z.-2 is next to apartment buildings and hospitals.

### Table 1. Facility Distribution within a 500-meter Radius

| Research facilities | Within a 100-m radius | Within a 200-m radius | Within a 300-m radius | Within a 400-m radius | Within a 500-m radius |
|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Education and cultural facilities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Commercial and business facilities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Recreation facilities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Religious facilities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Health and welfare facilities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Residential facilities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Other facilities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |

### Table 2. Outline of Residential Buildings

| Residental unit plan type | Area of residential unit (m²) | Number of residents | Area of kitchen (m²) | Number of residents | Sanitary spaces (m²) | Number of residents | Total area of residential unit (m²) | Number of residents |
|--------------------------|-------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-----------------------------------|---------------------|
| A                        | 30.7                          | 1                   | 10.3                | 1                   | 9.6                | 1                   | 40.2                             | 1                   |
| B                        | 30.7                          | 1                   | 10.3                | 1                   | 9.6                | 1                   | 40.2                             | 1                   |
| C                        | 30.7                          | 1                   | 10.3                | 1                   | 9.6                | 1                   | 40.2                             | 1                   |
| D                        | 30.7                          | 1                   | 10.3                | 1                   | 9.6                | 1                   | 40.2                             | 1                   |

6. Area of Exclusive Apartment Units, and Area of Exclusive and Indoor Common Spaces (within the Residential Buildings)

Table 2 indicates the respective characteristics of these apartment buildings. The average exclusive area of each apartment unit is 55.5 square meters in B.T.Z.-2 and 75.9 square meters in S.K.U.-5. Both B.T.Z.-2 and S.K.U.-5 show similar trends with regard to the area ratios of exclusive indoor spaces to indoor common spaces (within the residential buildings).

7. Results of Questionnaire Survey of Residents

Table 3 shows the distribution and collection of questionnaires to residents of B.T.Z.-2 and S.K.U.-5 (survey subjects: heads of households and their spouses).
### Table 3. Overview of Questionnaire Survey of Residents

| Bayanzag District Tumur Zam - No.2 | | | |
| --- | --- | --- | --- |
| Gross lot area | 16,472.3m² | Household | Spouse |
| Gross building area | 2,928.0m² | Number of people sent questionnaire | 100 |
| Gross floor area | 14,640.0m² | Number of people returning questionnaire | 82 |
| Total number of residential units | 240 | Ratio of questionnaires collected (%) | 82 |

| Sukhbaatar District Khut Uul - No.5 | | | |
| --- | --- | --- | --- |
| Gross lot area | 12,668.9m² | Household | Spouse |
| Gross building area | 2,526.9m² | Number of people sent questionnaire | 100 |
| Gross floor area | 9,045.9m² | Number of people returning questionnaire | 72 |
| Total number of residential units | 108 | Ratio of questionnaires collected (%) | 72 |

An overview of the questionnaire survey of residents is given in Part 1. At B.T.Z.-2, about 60% of the heads of households and their spouses were between the ages of 31 and 45, and over 80% of them had been living there for 10 years or less. At S.K.U.-5, about 35% of the heads of households were between the ages of 41 and 50, and about 25% of them were 61 or older. About 60% of their spouses were between the ages of 31 and 50, and about 13% of them were 61 or older. While over 50% had been living there for 10 years or less, about 30% were long-term residents who had been there for 36 years or longer. Looking at family size, at B.T.Z.-2, 64.5% of families had three or four members, the highest proportion; while 22.4% had five or more members and 13.1% had one or two members, in decreasing order of frequency. At S.K.U.-5, 60.8% of families had three or four members, the highest proportion; while 27.1% had one or two members and 12.3% had five or more members. A difference is seen between family sizes at B.T.Z.-2 and S.K.U.-5. While families of three or four members accounted for over 60% at both locations, the next highest proportion consists of families with five or more members at B.T.Z.-2 and families of one or two members at S.K.U.-5, each accounting for over 20%.

#### 7-1. Reasons for Living in Your Current Apartment Building (Fig. 2)

At B.T.Z.-2, both heads of households and their spouses responded that “It is a suitable means of living in the city” at a rate of about 30%, the most frequent response. Next in order of frequency were “It suits my preferences concerning residential space (apartment size, etc.) and price level” and “My apartment is larger than at the place I lived previously.” At S.K.U.-5, the most frequent response was “It suits my preferences concerning residential space (apartment size, etc.) and price level,” accounting for over 40%. The second most frequent response was “It is a suitable means of living in the city.” Among respondents who chose “Other,” the most frequent specific reason given was “I’m used to it here.”

#### 7-2. Level of Satisfaction with Residential Space

1) **Size** (Fig. 3)

At B.T.Z.-2, about 60% of heads of households as well as their spouses had a “neutral” opinion concerning the size of their residential space. Next, about 15% found it “somewhat poor,” while about 13% said it was “good.”

At S.K.U.-5, 36% of heads of households responded “neutral,” 24% said “somewhat poor,” and 20% said “poor.” Meanwhile, 50% of their spouses responded “neutral” while 31.8% said “poor.” A higher proportion of heads of households and their spouses had a neutral or negative opinion at S.K.U.-5 than at B.T.Z.-2, reflecting a large amount of dissatisfaction.

2) **Floor Plan** (Fig. 4)

At B.T.Z.-2, a high proportion had a “neutral” opinion concerning apartment layout, including about 60% of heads of households and about 50% of their spouses. The responses “somewhat poor” and “poor,” which indicate dissatisfaction, amounted to 27.2% of heads of households and 21.8% of their spouses.
households and 35% of their spouses. Meanwhile at S.K.U.-5, there was a higher level of dissatisfaction than at B.T.Z.-2, with 42.2% of heads of households and 59.1% of their spouses saying “somewhat poor” or “poor.”

3) Equipment and Functions (Fig. 5)

At B.T.Z.-2, about 38% of heads of households and their spouses were dissatisfied with the equipment and functions of their apartments, responding “somewhat poor” or “poor.” S.K.U.-5 had a higher proportion responding “somewhat poor” or “poor” than B.T.Z.-2, including 42.6% of heads of households and 71.5% of their spouses, who had a particularly low opinion concerning this aspect.

4) Hygiene and Safety (Fig. 6)

At B.T.Z.-2, 34.2% of heads of households and 25% of their spouses said this aspect was “good” or “somewhat good,” indicating more satisfied residents than those dissatisfied. At S.K.U.-5, 44.7% of heads of households responded “somewhat poor” or “poor,” as did 66.6% of their spouses, indicating a lower opinion among the spouses.

5) Convenience of Everyday Life (Fig. 7)

At B.T.Z.-2, about 55% of both heads of households and their spouses had a “neutral” opinion. Next, over 30% were satisfied, responding “good” or “somewhat good.” Meanwhile at S.K.U.-5, there was a high level of dissatisfaction, with 43.4% of heads of households and 52.4% of their spouses responding “somewhat poor” or “poor.” Again, spouses had a lower opinion.

6) Residential and Living Spaces in General (Fig. 8)

At B.T.Z.-2, 45.6% of heads of households and 36% of their spouses said this aspect was “good” or “somewhat good,” indicating more satisfied residents than those dissatisfied. There was more dissatisfaction at S.K.U.-5, about 36% of both heads of households and their spouses responding “somewhat poor” or “poor.” There is a high level of satisfaction at B.T.Z.-2, in contrast to a high level of dissatisfaction at S.K.U.-5, reflecting different opinions in these districts.

7-3. Intent to Reside Permanently

1) Intent to Stay or Move Away (Fig. 9)

At B.T.Z.-2, 32.4% of heads of households and 25.9% of their spouses said that they intended to stay for a long time, as did 34.8% of heads of households and 30.4% of their spouses at S.K.U.-5. The most frequent response at both buildings was “I have no plans to move for the time being but I would like to move in the future,” accounting for about 50%. This trend was notable among spouses.

2) Reasons for Staying (Fig. 10)

At B.T.Z.-2, the highest proportion of heads of households gave “The location is good” as their reason for intending to stay at the same apartment building, followed by “The surrounding environment is good” and “Economic reasons.” Among spouses, the most frequent response was “Economic reasons,” accounting for over 40%. Next in order of frequency were “The location is...
Meanwhile at S.K.U.-5, the most frequent response by heads of households was “The location is good,” accounting for over 50%; followed by “Economic reasons.” The highest proportion of spouses stated that “The location is good,” accounting for more than 40%; followed by “I like my apartment.” At S.K.U.-5, the desirability of the location seems to be the main reason for both heads of households and their spouses to stay there permanently. Meanwhile at B.T.Z.-2, the desirable surrounding environment and economic reasons are important reasons in addition to the desirability of the location.

3) Reasons for Moving Away (Fig. 11)

Residents who do not intend to stay for a long time, those who said “I plan to move away” or “I have no plans to move for the time being, but I would like to move in the future,” were asked why they want to move away. At B.T.Z.-2, the most frequent reasons given by heads of households were “Family reasons,” “Job-related reasons,” “I’m not satisfied with my current apartment,” and “Economic reasons.” Their spouses said “I’m not satisfied with my current apartment” or “I’m not satisfied with the residential environment (equipment, hygiene, safety, etc.).” At S.K.U.-5, heads of households stated “I’m not satisfied with my current apartment,” “Economic reasons,” or “I’m not satisfied with the residential environment (equipment, hygiene, safety, etc.),” in decreasing order of frequency. About 65% of their spouses stated “I’m not satisfied with the residential environment (equipment, hygiene, safety, etc.),” or “I’m not satisfied with my current apartment.” About 15% of heads of households as well as their spouses said “I’m not satisfied with the surrounding environment of my current apartment,” a higher percentage than at B.T.Z.-2.

4) Type of Housing Desired for Your Next Home (Fig. 12)

Residents who do not intend to stay for a long time, those who said “I plan to move away” or “I have no plans to move for the time being, but I would like to move in the future,” were asked what kind of housing they would like to occupy after moving away. At both B.T.Z.-2 and S.K.U.-5, heads of households and their spouses wished to move to an apartment (owned) or detached home (owned).
instead of only concerning themselves with their own apartments; and there is a sense of solidarity,” accounting for 28%. The next most frequent response, at 22.7%, was “The residents get along well with each other, and I have developed close interpersonal relationships.” Meanwhile, 17.5% of their spouses chose “It’s a good place to raise children or there is a good educational and cultural environment,” followed by “The residents get along well with each other, and I have developed close interpersonal relationships,” and “I appreciate the fact that everyone pitches in with maintenance and management of the living environment including the immediate vicinity, instead of only concerning themselves with their own apartments; and there is a sense of solidarity,” at about 15%. At S.K.U.-5, the most frequent response was “The residents get along well with each other, and I have developed close interpersonal relationships,” accounting for over 20% among both heads of households and their spouses. The next most frequent responses by heads of households were “I appreciate the fact that everyone pitches in with maintenance and management of the living environment including the immediate vicinity, instead of only concerning themselves with their own apartments; and there is a sense of solidarity,” and “The rules for collective living (such as assigned responsibilities) contribute to better well-being,” at about 15%, while 12.9% of their spouses said “The residents get along well with each other, and there is a good educational and cultural environment.”

Residents of both B.T.Z.-2 and S.K.U.-5 appreciate the positive aspects of a good living environment, educational and cultural environment, sense of solidarity among residents, and interpersonal relationships, including getting along well with each other.

2) Negative Aspects (Fig. 14)
The negative aspect indicated most frequently by both heads of households and their spouses at B.T.Z.-2 was “I am dissatisfied with the group activities of certain residents,” accounting for about 45%. The next most frequent response among heads of households was “Interpersonal relationships are difficult” at 28.4%, while 12.9% of their spouses said “The rules for collective living (such as assigned responsibilities) are restrictive and troublesome.” At S.K.U.-5, the most frequent response among heads of households and their spouses was also “I am dissatisfied with the group activities of certain residents,” followed by “Interpersonal relationships are difficult.”

Residents of both B.T.Z.-2 and S.K.U.-5 were concerned about the group activities of certain residents and interpersonal relationships.
7-5. Level of Satisfaction with Everyday Activities and Community Activities at Your Current Apartment Building (Fig. 15)

Residents were asked about their overall level of satisfaction concerning everyday activities and community activities that they have experienced while living at their current apartment building. At B.T.Z.-2, about 50% of both heads of households and their spouses were satisfied, selecting either “Quite satisfied” or “Somewhat satisfied.” However, about 38% were not satisfied, selecting either “Somewhat dissatisfied” or “Dissatisfied.” Meanwhile at S.K.U.-5, as many spouses were satisfied as those who were not, at 41.3% each. Only about 30% of heads of households were satisfied, and a larger number were not, or about 50%.

Different levels of satisfaction are seen at B.T.Z.-2 and S.K.U.-5 with regard to everyday activities and community activities at the apartment buildings. Overall, there are more satisfied residents at B.T.Z.-2 and more dissatisfied residents at S.K.U.-5.

8. Conclusions

There has been a remarkable influx of population to seek employment opportunities in Ulaanbaatar since the democratic revolution. Apartment buildings and permanent ger housing on the outskirts of the urban parts of the city exist to support this concentrated population. A report entitled “Comprehensive Plan for Urban Development of Capital Ulaanbaatar until 2020” states the goal of housing about 80% of all residents in apartment buildings in light of the economic growth rate and investment forecasts.

In this paper, we have determined the overall conditions and characteristics of living spaces at apartment complexes located in urban parts of Ulaanbaatar by means of a questionnaire survey of residents, an overview of the spatial configuration of the apartment buildings, and a comparative study of the distribution of various types of facilities, in order to identify the conditions of residential and living spaces at two apartment buildings with differing layouts. The following is a summary of our findings.

1) Over 60% of the families living in these buildings have three or four members. Most have lived there for ten years or less, and about 40% have been in their present apartments for five years or less. The overall length of residence is not very long at either of the apartment buildings. Meanwhile at S.K.U.-5, about 30% of the residents have been there for 36 years or more; about 30% of the households consist of only one or two family members, and many senior citizens aged 61 and older live there. These factors point to aging of the resident population in this apartment building.

2) By analyzing the facility distribution at 100-meter radius intervals with regard to various types of facilities in the living space located within a 500-meter radius of two apartment buildings with differing layouts, we were able to determine differences in the localational environment and characteristics of the surrounding environment of each apartment complex.

3) The area ratios of the indoor common spaces (staircase halls, elevator halls, common corridors etc.) in the two apartment buildings with different layouts reflect the effect of residential layout planning, the number of staircases, the number of floors and so on. Moreover, with regard to outdoor common spaces, in B.T.Z.-2, an apartment building with a parallel layout, many everyday activities that are integrally related to the lifestyles of the residents with one another are conducted, and there is a high degree of satisfaction on the part of residents with regard to everyday activities and community activities. At S.K.U.-5, an apartment building with a courtyard enclosure layout, the location of the apartment building makes it fulfill the function of a public space, and many activities are conducted by people other than residents. For this reason, the degree of satisfaction on the part of residents with regard to daily and community activities is low.

4) When residents were asked why they live in their current apartment building, the most frequent reason given at one building was “It is a suitable means of living in the city,” but at the other building, the most frequent response was “It suits my preferences concerning residential space (apartment size, etc.) and price level.” The reason chosen seems to be related to the size of the respondent’s apartment.

5) When asked about their level of satisfaction with the residential space, many residents at both apartment buildings were dissatisfied with the size and floor plan, showing a low opinion concerning these aspects. Differences in the locations and surrounding environments of the apartment buildings were related to different opinions concerning hygiene, safety, and convenience of everyday life. There was a great deal of dissatisfaction in this regard among residents of S.K.U.-5, which faces a major road in an area with many commercial facilities. Therefore, in their overall opinion of “residential and living spaces in general,” low marks were given for the aspects of hygiene, safety, and convenience of everyday life, which are related to the

Fig.15. Level of Satisfaction with Everyday Activities and Community Activities at Your Current Apartment Building
location and surrounding environment of an apartment building.

6) Many residents stated that they would like to move away. Only about 30% of residents said they intended to stay in their present apartments for a long time. Among those who did intend to stay, the reasons given were reflective of the surrounding environment of their apartment building. At S.K.U.-5, it was because of the desirable location; and at B.T.Z.-2, it was because of the desirable surrounding environment in addition to the location. Among those who intended to move away, a frequent reason was dissatisfaction with their current residential environment (equipment, hygiene, safety, etc.). At S.K.U.-5, an apartment complex which faces a major road in an area with many commercial facilities, another reason was dissatisfaction with the surrounding environment, reflecting the location of this building.

When asked about the type of housing desired for their next home, most stated that they wished to own an apartment or detached home within Ulaanbaatar.

7) When asked about positive aspects of everyday activities and community activities at their current apartment building, residents said they appreciate a good living environment, educational and cultural environment, sense of solidarity among residents, and interpersonal relationships, including getting along well with each other. When asked about negative aspects, they cited the difficulties of interpersonal relationships and the group activities of certain residents.

8) The residents’ level of satisfaction with everyday activities and community activities at their current apartment building was correlated with their evaluation of the residential and living spaces in general (under “Level of satisfaction with residential space”). This seemed to be reflective of the characteristics of the residential environment and surrounding environment of each apartment building, rather than the size of the apartments.

There is a need for further research concerning the planning of residential and living spaces for apartment buildings, based on the environment of the particular city or area where a building is located, including the determination of relationships between the community and an apartment building’s location and surrounding environment.

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Previous Publication Related to This Study
1) Mitsuhiro Hasegawa, Umekazu Kawagishi, Ishjamts Gonchigbat, Takumi Nakanishi (2004.5) Study on the Living Space Planning in Ulaanbaatar, Mongolia - Common Spaces in Apartment Complexes -. Journal of Asian Architecture and Building Engineering, AJJ, AJK, ASC, vol.3 no.1, 133-140