

** A Case Study on Transition of plan-type by Transfiguration of Housing Complexes in Seoul Area

서울지역 집합주거단지의 변모에 따른 평면형식의 변화에 관한 연구

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Abstract

본 연구는 현대 집합주택의 개발의 실험적 토대가 되었던 1960년대 이후 1990년대 초반까지의 서울지역 아파트단지들을 중심으로 단지의 측면과 단위평면의 측면에서 시대적 변천과 유형별 특성을 분석하여 국내 집합주거의 양상이 어떻게 전개되어 왔는지를 인식하고, 국내 집합주거의 질적 향상을 위한 대안을 제시하고자 하는 주후 연구의 한 준거를 제시토록 한다. 이를 위하여 집합주거의 생성과 현황에 대하여 일반적인 고찰을 진행하여, 국내 주거양식이 점차로 고층, 고밀화되어가는 과정을 살펴보고, 이러한 주거양식의 집합화가 점차로 정책적인 차원에서 더욱 고려되어지고 있음을 현대에 이르기까지의 시대적 틀 속에서 고찰해 본다. 이와 함께 집합화되는 주거양식이 단위평면속에서는 어떻게 변천해 왔는지를 규모와 체실구성, 설비 및 구조방식, 내부공간 구성방식등으로 나누어 분석한다.

키워드 : 집합주택, 주택형태, 평면형식, 변천

Keywords : Housing Complex, Housing Type, Plan type, Change

1. Introduction

1.1. Background and Purpose of Study

Since the 1970s, rapid economic growth and high population concentration in big cities have caused serious housing problems in Korea. As a solution for the problems, a large number of apartments have been built, and apartment has become a representative type of residence in large cities of Korea. Such type of housing has been widely adopted as a quick solution for housing shortage because of the advantages of high-density housing, wide exterior space, and concentrated amenities; but such housing type has also several problems, such as lack of interaction among neighbors, discontinuity of Korean traditional housing custom, and impersonal exterior space, as well as lack of building cohesion. According to the current housing policy of the Korean government, a large scale of super high-rise apartments are being built mainly to increase a total supply rate of housing by ignoring the quality of housing, and

resulting in constructing uncharacteristic, uniform apartments.

This policy has caused another urban housing problem in Korea. The new housing policy promotes the development of New-Towns in existing residential areas, and high-rise apartments are currently accepted as the most representative type of urban housing. However, strictly speaking, this new type of housing is not much different from the old housing complexes developed since the 1960s.

Based on this background, this study will analyze the characteristics and the changes of collective housing built until the 1990s in terms of the unit plans of major apartment complexes to find out how the types of collective housing have been formed and developed at different times. From the results of the analyses, the guidelines for future research will be suggested to improve the quality of collective housing.

1.2. Scope and Method of Study

The current type of collective housing in Korea was originally adopted from the type formed in the West since modern times. This study will analyze data published by Korea National Housing Corporation on apartment complexes constructed in Seoul between 1960s to the early 1990s, which

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have played an important role in developing the types of collective housing in Korea, and the study will be proceeded as follows:

In Chapter 2, the formation and the current situation of apartment complexes will be reviewed, and the progress of higher and denser housing type will be presented.

In Chapter 3, the development of such housing type, in the context of the housing policy of the government, will be reviewed chronologically, focusing on collective housing.

Finally, in Chapter 4, the changes of housing complexes will be analyzed in terms of the unit size, the layout of rooms, the method of equipment and structure, and the system of inner space.

2. Current Situation of Housing Complexes in Korea

Most countries have experienced serious housing problems after urban development. To solve the problems, western developed countries considered housing problems in relation with public health issues, and enacted the public health law, including clauses for the improvement of residential environment. For example, the 1848 Public Health Act of Britain was the first such law, recognizing housing problems in connection with the improvement of poor housing environment causing diseases. It was revolutionary in that it dealt with public health issues in the context of urban development.¹⁾

2.1. Development of Housing Complexes in Korea

(1) In the 1960s

Between the 1950s and the early 1960s, a few complexes of small-size detached houses, ranging from 7.5pyeong(24.75 m²)²⁾ to 18pyeong(59.4m²), were constructed in the outskirts of Seoul. After the 1960s, the horizontal expansion of urban areas was prohibited, the increased efficient use of land was promoted, and collective housing of reflecting the preference of a western lifestyle were introduced.

Mapo Apartment Complex built in 1962 was the first such housing complex in Korea. During this period, the types of apartment complex were formed, and mid-rise and low-rise apartments, lower than 5 stories, were mainly constructed. Representative apartments are Mapo Apartment(1962), Hangang Public Servant Apartment(1966), and Citizens Apartment(1967-1970).

(2) In the 1970s

Due to the government's policy concentrating on the economic growth of large cities, a migration of rural population into urban areas became very serious. As a result, a demand for housing was increased, available residential land was not enough, and the price of land went up. To maximize the land use, higher housing complexes were built. Yeoyido Sibum Apartment, built in 1971, was 12-story housing with various unit types, ranging 18pyeong(59.4 m²)-48pyeong(158.4m²).

After the mid 1970s, private developers started to build high-rise apartments. In the case of Hwagok Sibum Apartment Complex built between 1976 and 1978, town houses and low-rise apartments were usually built to produce a garden style environment by incorporating local geographical characteristics and natural landscape. Representative apartments of this period are Yeoyido Sibum Apartment(1971), Banpo Apartment(1972-1974), Jamsil Apartment(1975-1977), and Hwagok Sibum Apartment Complex(1976-1978).

(3) In the 1980s

During the 1980s, as a housing supply rate was further dropped and the urban population concentration became serious, more apartments were built. To solve a shortage of housing and to spread the population of the Seoul metropolitan area, new towns such as Gwacheon(1979-1983), Godeuk(1982-1985), Mokdong(1983-1988), and Sanggye(1985-1989) were developed. Apartment types of this period were mainly high-rise buildings more than 10 stories, despite efforts of developing various types of housing by arranging both low-rise and high-rise apartments in the same complex. Additionally, according to the Two Million Housing Construction Plan of 1988, new towns were developed in five districts in the metropolitan area: Bundang(1989-1992), Ilsan(1989-1995), Sanbon(1989-1995), Pyeongchon(1989-1995), and Jungdong(1989-1995).

2.2. Changes in the Housing Supply Policies

The housing supply rate during the 1960s was over 80%, but it was dropped drastically between the 1970s and the 1980s due to the increased population and the trend toward

1)Ha, Sung-gyu. The Policy of Housing. Publisher: Bakyoung Co, 1991, pp.12-15

2)A pyeong(坪) is a unit of measurement in Korea, equivalent to 3.3m². It is used most often referring to the sizes of rooms or buildings.

nuclear family. Additionally, as a lot of money flowed in the real estate market in the late 1970s, housing and land prices rose high. In response to the problems, the government launched the Two Million Housing Construction Plan between 1988 and 1992, and the housing supply rate started to go up again during 1987 and 1988.

From the First Five-year Economic Development Plan started in 1962, a housing supply rate by public builders was drastically dropped to 12.2%; whereas the total housing supply by private builders was increased. The reason was that most government funds were invested in the basic infrastructure and heavy industries, so a housing shortage was not a major concern for the government. Later, the housing supply rate by the public sector steadily increased, and the supply rates of the end of 1970s and the early 1980s were 44.4% and 47.6%, respectively <Table 1>.

In the 1970s, with the development of Gangnam area, the horizontal expansion of Seoul was accelerated to encourage the population in Gangbuk area to move to Gangnam area, but the population in the country or small- and medium-size cities started to move in Seoul, and a widespread real estate speculation greatly increased the price of land.

In the 1980s, the slogans of 'The Two Million Housing Construction Plan' and 'The Five Million Housing Construction Plan' were not at all rational policies, but rather demonstrative, impromptu policies, causing many socioeconomic problems such as shortage of materials and manpower, poor workmanship, increased labor cost, unstable economy, traffic congestion, and damage to environment, without being able to stabilize housing price.³⁾

<Table 1> Housing Construction Volume of Public/Private Builders by the Period of Economic Development

		1st Period 1962-1966	2nd Period 1967-1971	3rd Period 1972-1976	4th Period 1977-1981	5th Period 1982-1986	2 Million Plan 1988-1992
Constr uction Volume	Total	325,935 (100)	540,338 (100)	760,591 (100)	1,116,074 (100)	1,155,071 (100)	2,142,000 (100)
	Public	39,915 (12.2)	69,613 (12.9)	228,766 (30.0)	495,378 (44.4)	549,344 (47.6)	710,000 (33.2)
	Private	286,020 (87.8)	470,725 (87.1)	531,825 (70.0)	620,696 (55.6)	605,727 (52.4)	1,432,000 (66.8)

(Unit: Housing unit, %)⁴⁾

3. A Review on the Changes in Housing Complexes in Seoul

3.1. Housing Complexes in the 1960s

(1) Mapo Apartment

Mapo Apartment Complex was built on the land at #7-14,

<Table 2> Summary of scheme - Mapo Apartment

Location	Dohwa-dong, Mapo-gu, Seoul ⁵⁾		
Land area	46,747㎡	Building coverage ratio	11%
Floor area ratio	67%	No of housing units	642
Housing density	137units/ha, 507persons/ha ⁶⁾	No of floors	6
Pyeong types	9, 12, 15, 16	Construction period	1962-1966

Dohwa-dong, Mapo-gu, Seoul; the land was purchased by KNHC from the Seoul Metropolitan Government. Originally, the complex was designed to be 10-story buildings with 1,158 housing units, equipped with elevators, but due to lack of funds and electricity, the design was modified to 6-story buildings. However, the elevator shaft was remained to hold elevators in the future. The apartment complex was demolished on March 28, 1991. Mapo Apartment had 6 building blocks, in the center of the complex, clustered in a Y-shape, and 4 building blocks on the outer part of the complex, arranged in a straight form. The complex was divided by straight roads(15m wide and about 230m long). The structure of the overall exterior space can be divided into the entry/exit space around the gate and the green space because of the Y-shaped cluster of building blocks.



<Figure 1> Airview of Mapo APT

(2) Hangang Public Servant Apartment

<Table 3> Summary of scheme - Hangang Public Servant Apartment

Location	Ichon-dong, Yongsan-gu, Seoul		
Land area	87,174㎡	Building coverage ratio	19%
Floor area ratio	76%	No of housing units	1,132
Housing density	150units/ha, 555persons/ha	No of floors	5
Pyeong types	12, 15, 17, 20	Construction period	1966-1969

This large-scale apartment complex is the first of its kind with 5-story tower-type building blocks that are aligned uniformly in parallel to each other; it has the grid road system in the complex. By adopting the concept of neighborhood unit, the complex has an elementary school and middle school within the complex, as well as other community and service facilities such as a shopping center, a

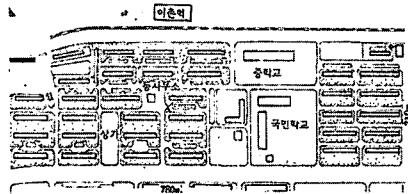
3)Yang, Yun-jae, Environment and the Role of Architect, Urban Architecture, 9305, p.59

4)Handbook of housing staousitistics, the Korea National Housing Corporation, 1990

5)The Korea National Housing Corporation, Housing Conspectus of The Korea National Housing Corporation 1954-1970, reorganization, The same reorganization to the following Tables

6)The average number of people for each household in Korea is 3.7 persons as of 1992. (The National Statistical Office, Social indicators in Korea, 1992, p.304)

post office, a shopping mall, and a town office. The entrance of the building blocks is placed on the south side, so an access to the outside space of the south side was easy, but the privacy of the housing units on the first floor, especially rooms facing the south (e.g., livingroom, main bedroom) could be vulnerable. A



<Figure 2> siteplan of Hangang Public Servant Apartment

uniform arrangement of the apartment complex is a result of considering the residents' preference for apartments facing south.

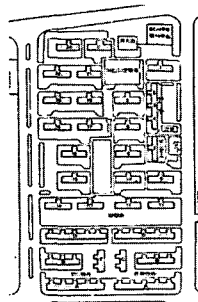
3.2. Apartment Complexes in the 1970s

(1) Yeoyido Sibum Apartment

<Table 4> Summary of scheme - Yeoyido Sibum Apartment

Location		Yeoyido-dong, Seoul	
Land area	111,138㎡	Building coverage ratio	-
Floor area ratio	-	No of housing units	1,584
Housing density	143units/ha, 541persons/ha	No of floors	12
Pyeong types	18,24,26,28	Construction period	1971

In 1971, Yeoyido Sibum Apartment was constructed to lead the development of Yeoyido area. This complex is the first high-rise 12-story apartments in Korea. Like Hangang Public Servant Apartment, building blocks were arranged straight, facing south. This type of building arrangement is the most commonly used in Korea. This building block is located about 50m away from the road, so it is not affected by noise; also, because the blocks are placed perpendicular to each other, it is easy to develop an open space within the complex. There are only minimum community and service facilities within the complex, such as parks, children's playground, and a shopping mall. This complex is surrounded by the existing roads, so street parking lots are available in the front and back space of each building block; both pedestrians and cars share the same circulation space.



<Figure 3> siteplan of Yeoyido Sibum Apartment

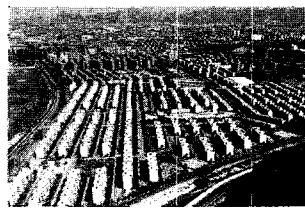
(2) Banpo Apartment Complex

Banpo Apartment Complex had the advantages of an easy access to the center of Seoul, and urban infrastructures. In order to align building blocks evenly, the same unit plans are used within the same block. The space between

<Table 5> Summary of scheme - Banpo Apartment Complex

Location		Banpo-dong, Seocho-gu, Seoul	
Land area	554,155㎡	Building coverage ratio	17%
Floor area ratio	77%	No of housing units	3,784
Housing density	68units/ha, 252persons/ha	No of floors	5
Pyeong types	22,32,36,42,64	Construction period	22,32,36,42,64

building blocks is 1.5 times of the height of building block. All building blocks are facing south; the access to the entrance is on the south side, and the parking lot is constructed on the front side of each block. As a result, the complex has favorable daylight penetration, but has a uniform view. Among the street networks of Banpo Complex, roads by the river are transit roads, so the distance between



<Figure 4> Banpo Apartment Complex

building blocks and the riverside roads is as wide as 25-30m in order to block noise; whereas the roads within the complex are designed to be as service roads, not as transit roads.

(3) Jamsil Apartment Complex

<Table 6> Summary of scheme - Jamsil Apartment Complex

Location		Jamsil-dong, Seoul	
Land area	1,388,020㎡	Building coverage ratio	Mid-rise(15%) High-rise(9%)
Floor area ratio	Mid-rise(72%) High-rise(121%)	No of housing units	19,180
Housing density	138units/ha,511persons/ha	No of floors	5, 15
Pyeong types	7.5, 10, 13, 15, 17, 19, 34, 35, 36	Construction period	1975-1984

In Jamsil Apartment Complex, the building blocks of mid-rise are arranged in a courtyard style; 4 building blocks are formed as a housing group, repeatedly. A square-shaped arrangement of building blocks does not disconnect exterior space; it is advantageous in securing a wide exterior space. This type of courtyard arrangement allows to create various landscapes, as well as playground and small parks. Additionally, it can facilitate interactions among residents. Tower-type apartments are placed in the center of the complex. The road network of Jamsil's high-rise apartments has a loop shape that is effective and simple.



<Figure 5> Jamsil Apartment Complex

3.3. Housing Complexes in the 1980s

(1) Gwacheon New Town

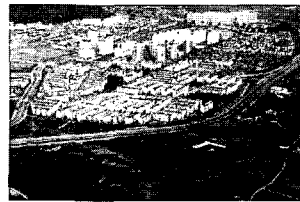
Gwacheon New Town was planned to solve the

<Table 7> Summary of scheme - Gwacheon New Town

Location	Gwacheon-si, Gyeonggi-do		
Land area	2,956,000㎡(1,241,784㎡) ⁷⁾	Building coverage ratio	16%
Floor area ratio	92%	No of housing units	14,208
Housing density	48/ha(115units/ha) 78/ha(426persons/ha)	No of floors	3,5,13,14,15
Pyeong types	7.5-45	Construction period	1980-1984

overcrowding in Seoul. to use the land more intensively, high-dense apartment complexes, which are similar to the large complexes in Seoul, are developed.⁸⁾ However, in Gwacheon New Town, a new design of various housing types such as town house, detached house, and high-rise/mid-rise/low-rise mixed apartments are tried to reduce housing density.

Gwacheon New Town can be divided into Complexes 1,2,3, and 4 by the road system. Educational facilities and amenities for residents are placed in each complex. On the



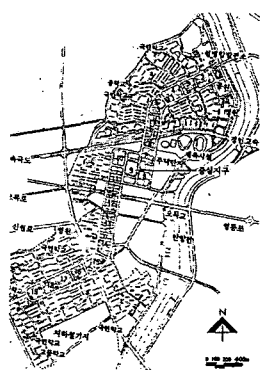
<Figure 6> Gwacheon New Town

east side of the main road which crosses through Complex 1, there are middle school, high school, town house, and detached houses. On the west side of the main road, 5-story building blocks are arranged straight, and they are placed perpendicular or parallel to the 30m-long main local road. Complex 2 on the southwest of the apartment complex is divided into four areas by the cross-shaped road within the complex. Two housing blocks on the south are 5-story building blocks that are arranged lineage type, and they are placed perpendicular or parallel to the main local road, like Complex 1.

(2) Mokdong New Town

<Table 8> Summary of scheme - Mokdong New Town

Location	Mok-dong, Yangcheon-gu, Seoul		
Land area	4,375,033㎡ (2,038,073㎡)	Building coverage ratio	14%
Floor area ratio	143%	No of housing units	26,629
Housing density	61/ha(131units/ha), 178/ha(485persons/ha)	No of floors	5, 12-20
Pyeong types	18-39, 42-57	Construction period	1983-1988



<Figure 7> Siteplan of Mokdong New Town

Mokdong New Town is occupied at a area of about 4.5km long and 1.2km wide. Town's central facilities such as park, telephone office, post office, district office, and commercial facilities are placed along the 250m-long road, running north to south; so the new town is divided into east

and west. Three major roads crossing the complex are designed to run underground beneath the central facilities, not to interrupt the facilities of the complex. Most of the building blocks on the northeast side and southwest side are placed parallel to the central area, but most of the blocks in the middle are placed perpendicular to the central area. The vehicle circulation has a loop type circulating the central area, running one way; the existing road network in its vicinity is used in the complex.

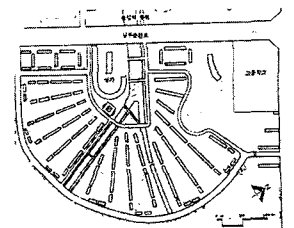
(3) Olympic Athletes Village Apartment Complex

<Table 9> Summary of scheme - Olympic Athletes Village Apartment Complex

Location	Ogum-dong, Gangdong-gu, Seoul		
Land area	727,276 ㎡	Building coverage ratio	12%
Floor area ratio	137%	No of housing units	5,476
Housing density	75 units/ha, 274persons/ha	No of floors	6,8,10,12-16, 18,20,24
Pyeong types	25-64	Construction period	1986-1988

This complex was constructed based on the winning design from the 1985 International Design Competition to mark a revolutionary record in the Korean housing history and to build a monumental place.⁹⁾

In relation with the entrance of Olympic Park, a square is developed. Centering on this area, buildings and public space are constructed in the radial shape, looking like the fan's ribs, and part of the Press center area, which is adjacent to the outer road, and the northwest side of Athlete's Village are developed in a lattice type. This complex is largely composed of housing blocks and parks along the road. By designing a square between housing blocks, and by placing playgrounds and green zone between blocks, the parks adjacent to the roads can have variations and a noticeable order at the same time. Both street parking lots between blocks and the basement parking lots are planned.



<Figure 8> Siteplan of Olympic Athletes Village Apartment Complex

7)the land area can be differentiated into 1) the total land area, which is planned, and 2) the net land area, which is actually used for construction. For apartment complexes presented earlier, the total land area and the net land area are the same. However, for the case of Gwacheon New Town, several other urban infrastructures were included in addition to the apartment complex, so the total land area and the net land area are considered separately to analyze the differences in terms of the housing density.

8)The Korea NationalHousing Corporation, History of Gwacheon New Town Development, 1984, p.1

9)Woo, Gyu-sung, Design of 1988 Olympic Athlete's Village Gijachon Apartment, Plus, 8807, p.85

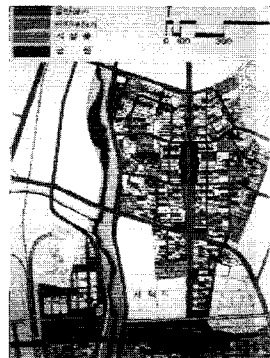
(4) Sanggye New Town

<Table 10> Summary of scheme - Sanggye New Town

Location	Sanggye-dong, Nowon-gu, Seoul		
Land area	3,300,940m ² (1,774,243m ²)	Building coverage ratio	-
Floor area ratio	130%	No of housing units	30,800
Housing density	94/ha(177units/ha), 348/ha(665persons/ha)	No of floors	5 - 25
Pyeong types	11-38	Construction period	1986-1989

As for the solution for a housing shortage and a balanced development between Gangnam and Gangbuk areas, a large-scale of apartment complexes are constructed at Sanggye-dong, located at the northeast of Seoul.¹⁰⁾ Until then, a straight arrangement of building blocks has been common, but in Sanggye New Town, various shapes of blocks such as a bended shape, U-shape, double Y-shape, Z-shape, and mixed shape are applied for the increased use and improved landscape of the complex.

The complex is divided into two parts by a transit road running north to south. Educational facilities are placed in each complex, and building blocks usually face south and are placed perpendicular to the road crossing the new town. Shopping Complex in the center of the city is facing the road which crosses the new town north to south. Because existing roads are used in the complex, the vehicle circulation system is not one loop circulating the whole new town, but a loop circulating 2-3 complexes.



<Figure 9> Sanggye New Town

3.4. Apartment Complexes in the 1990s

(1) Bundang New Town

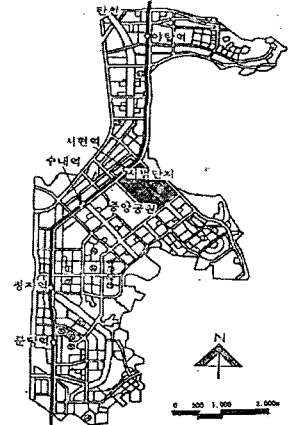
<Table 11> Summary of scheme - Bundang NewTown

Location	Bundang-gu, Gyeonggi-do		
Land area	19,675,273 m ²	Building coverage ratio	-
Floor area ratio	-	No of housing units	97,500
Housing density	50 units/ha, 185 인/ha	No of floors	3,5,13,14,15
Pyeong types	12 - 79	Construction period	1989-1994

As part of the Two Million Housing Construction Plan which has started from 1988, the development of new town was announced in April 1989 to solve housing shortage and to control real estate speculation in mid- and large-size apartments in Gangnam area of Seoul.

Using the local road system as a central axis, the main road system of Bundang New Town is constructed to

connect 6 small zones of Bundang area, north to south; the auxiliary roads are connected to this main road in a loop form to reduce the traffic of the area. Super high-rise apartments, which were tried first in Sanggye New Town, are constructed in a large scale in Bundang New Town by private builders. The housing density of the total land area of Bundang New Town is lower than that of Mokdong New Town Apartment Complex or Olympic Athlete's Village Apartment Complex. It is a result of separating housing blocks from parks/green areas, and by using a concentrated arrangement of housing blocks.



<Figure 10> Bundang NewTown

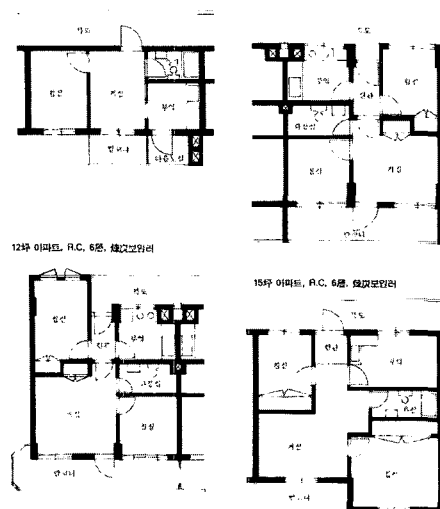
4. Chronological Analysis of the Unit Plan

Types of Collective Housing

4.1. Chronological Analysis of area & zoning of unit plan

(1) analysis of the unit plan in the 1960s

In Mapo apartment, the 9-pyeong type (29.7m²) is the smallest unit, and it has a corridor access type. The unit plan is for 2 persons, and it has a livingroom, 1 bedroom, a kitchen, a bathroom, and a porch/corridor. Despite its small inner space, the kitchen is completely separated from the livingroom. The livingroom and kitchen are placed closely,



<Figure 11> Plan Types in Mapo Apartment

but they are not open to each other. It is due not only to Korean life style, but also to the kitchen's dual functions of cooking and heating (individual coal briquette boiler).

In the case of

10)The Korea National Housing Corporation, The 30-year history of the Korea National Housing Corporation, 1992, p.270

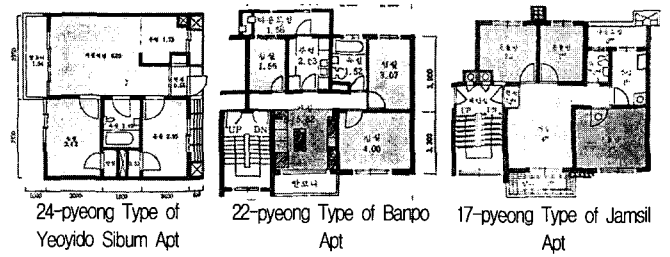
the 16-pyeong type, each housing unit can be accessed through the staircase. In each unit plan, a livingroom, a kitchen, a toilet room, and a bathroom are placed centering around the porch, and two bedrooms are connected to the livingroom. That is, the kitchen, the toilet room, and the bathroom can be accessed directly from the porch, and two bedrooms can be accessed through the livingroom as a medium space. The livingroom and one bedroom are connected to the front balcony, and the doors of two bedrooms are open to the livingroom. The kitchen, the toilet room, and the bathroom are clustered in one area to share the equipment duct. The back balcony behind the kitchen has a function of a utility room, as well. Even though it is a 16-pyeong type, the toilet room and the bathroom are constructed as independent space which is divided by the wall.

Hangang Public Servant Apartment Complex is composed of the 12, 15, 17, and 20 pyeong types. Each housing unit can be accessed through the staircase. The 12-pyeong type has two bedrooms, a kitchen, and a bathroom; each room can be accessed through the porch/corridor. In this pyeong type, there is no livingroom, so the bedroom has a combined function of a livingroom.<Table 13>

The 15-pyeong type of Hangang Public Servant Apartment is for 3-4 persons. The livingroom and bedroom-1 are facing bedroom-2, bathroom, and kitchen symmetrically. The livingroom is designed as an independent room, so it does not have a central role in the unit plan. Between the livingroom and the master bedroom, a moveable partition is placed to provide flexibility between the two rooms. Each room can be accessed through the corridor, so the corridor area is relatively big, but the arrangement of each room and the division of an area cannot be done easily.

(2) analysis of the unit plan in the 1970s

Yeoyido Sibum Apartment Complex is composed of the 18, 24, 36, and 48 pyeong types. In the 24-pyeong type, each housing unit can be accessed through a corridor. It is a unit plan for 3-4 persons with the room layout of bedroom-1, a kitchen, a porch/corridor, bedroom-2, and a bathroom. Among

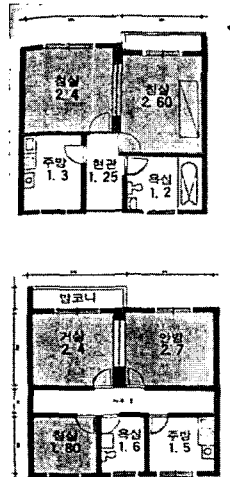


<Figure 13> Unit Plan of the 1970s

the unit plans under study, a unified space between the livingroom and the kitchen without a wall is first tried in this unit plan. Two bedrooms have a separate closet. The kitchen area is smaller than that in the 15-pyeong type (6.25 m²) of Hangang Public Servant Apartment; but by combining the kitchen and livingroom, the dining space looks like being included in the livingroom. Compared with Hangang Apartment, an unnecessary area in the unit plan is removed, and a flexible space between livingroom and kitchen is tried by getting rid of a partition between them.

Banpo Apartment Complex is composed of the 22, 32, 42, and 64 pyeong types. Only the 22-pyeong type with a high distribution is analyzed for this study. In this pyeong type, each housing unit can be accessed through a staircase. It is a unit plan for 4-5 persons with a porch/corridor, bedroom-1, a kitchen, a bathroom, bedroom-2, and bedroom-3 centering around the livingroom. In Hangang Apartment and others, a completely western style floor plan is designed, but there is a wall between the livingroom and the kitchen, limiting circulation. However, in Banpo Apartment, three variations are tried: 1) a wall between kitchen and livingroom; 2) a completely open kitchen without a wall; and 3) a semi-open kitchen with a folding curtain. The kitchen and the bathroom are located in the area of bedroom, and they are placed closely to share an equipment wall. The back balcony is used as a utility room.<Table 13>

In the 17-pyeong type of Jamsil Apartment Complex also, each housing unit can be accessed through the staircase. It is a unit plan is for 4-5 persons with a porch/corridor, bedroom-3, bedroom-1, a toilet room, a kitchen, a back balcony, and bedroom-2, placed centering around the livingroom. The kitchen and the toilet room are placed closely to share an equipment wall. The livingroom faces south, and it is placed between bedroom-2 and bedroom-3, and across from the largest bedroom-1.

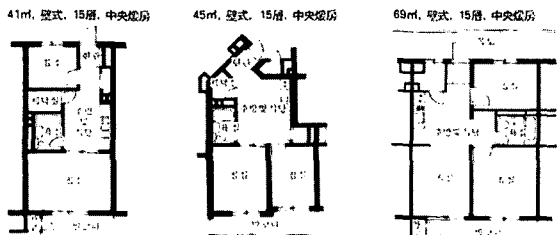


<Figure 12> Hangang Public Servant Apt (12, 15-pyeong Type)

There is a corridor between kitchen and livingroom, and a toilet room without a bathtub is placed. The 17-pyeong type is relatively small, but bedroom-1 has a comparatively spacious area (12m²). In Jamsil Apartment, both the coal briquette floor-heating system and the coal boiler are used. The 7.5-pyeong type had the boiler heating system, whereas the 17-pyeong type and the 15-pyeong type have the coal briquette floor-heating system.

(3) analysis of the unit plan in the 1980s

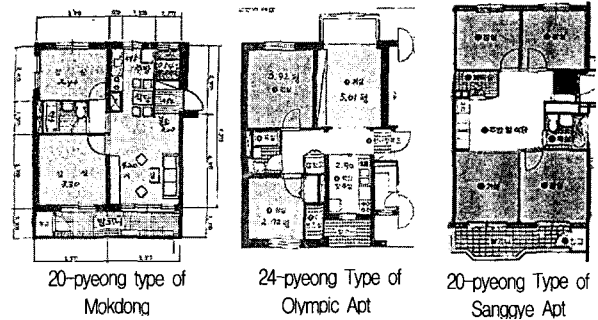
In the 16-pyeong type of Gwacheon New Town Apartment, each housing unit can be accessed through the staircase. It is a unit plan for 3-4 persons with a laundry room, a bathroom, bedroom-1, 2, centering around the livingroom and the kitchen; the kitchen and livingroom are integrated as one space, and the livingroom has a dinning function also. A small, extra space is used as a storage room, and various plans are tried when constructing housing units. By integrating the kitchen and the livingroom, a circulation area is reduced to 1.65m². A relatively small private use area of 44.93m² is divided for an effective use of rooms.<figure 16>



<Figure 14> Plan Types in Gwacheon New Town

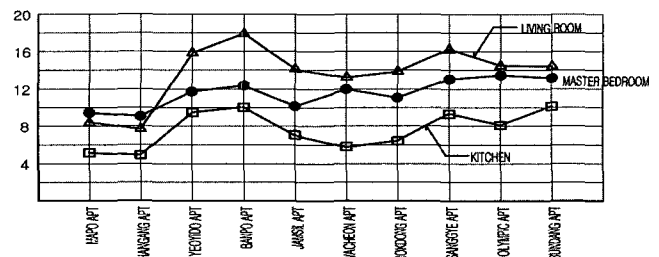
Mokdong New Town is composed of the pyeong types between 18 pyeong and 58 pyeong. In this study, the 20-pyeong type units from 4 apartment complexes are analyzed. Either access type has a similar room structure, dividing a bedroom area and a livingroom-kitchen-dining room area. A service area is maximized by securing a wide front balcony; a utility room and a storage room are placed in the kitchen area. Because the diningroom is integrated into the kitchen, the layout is a little complicated, but the space is placed near the livingroom, providing a spacious dinning space. The 25-pyeong type of Olympic Athlete's Village Apartment Complex can be accessed through a staircase. The porch/corridor, kitchen/diningroom, bedroom-1, bathroom, and bedroom-1 are placed centering around the livingroom. A utility room can be accessed through the

balcony behind the kitchen, and a small storage space is placed between bedroom-1 and the kitchen/diningroom. In this pyeong type, a unit plan for 3-4 persons with 2 bedrooms is designed. There is no partition between livingroom and kitchen/diningroom, and an inner storage room is placed between bedroom-1 and kitchen/diningroom.<Table 13>



<Figure 15> Unit Plan of the 1980s

In Sanggye New Town, a flexible unit plan of the 20-pyeong type is analyzed. The flexible housing unit of the 20-pyeong type uses a staircase access system. It is a unit plan with a livingroom, a utility room, bedroom-2, bedroom-3, the porch, bathroom, and bedroom-1, placed centering around the kitchen/diningroom. By placing a movable partition between bedroom-2 and bedroom-3, and a partition between bedroom-1 and livingroom, a resident can adjust the number and size of rooms when necessary. If combining bedroom-2 and bedroom-3, a oblong bedroom with a width-to-length ratio of 2:1 can be formed, and the area will be unnecessarily too big (16.2m²). Therefore, combining rooms will be unreasonable for usual use, but can be useful for a special family occasion. Combining a livingroom and bedroom-1 can be considered not as an extension of bedroom, but as an extension of livingroom. Such a flexible pyeong type can be convenient for residents who wish to change rooms according to their needs, but a partition between bedrooms or between the livingroom and a bedroom is not movable, so the kitchen/diningroom has a central function in the unit plan.



<Figure 16> Graph of change of major space' area

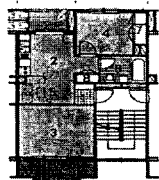
<Table 12> Analysis of the Characteristics of Housing Complex

	Mapo APT	Hangang Public Servant Apt	Yeoyido Sibum Apt	Banpo Apt	Jamsil Apt	Gwacheon New Town	Mokdong New Town	Olympic Athlete's Village Apt	Sanggye New Town	Bundang New Town
Housing Density	170units/ha 507persons/ha	150units/ha 555persons/ha	143units/ha 41persons/ha	68units/ha 252persons/ha	138units/ha 511persons/ha	115units/ha 426persons/ha	131units/ha 485persons/ha	75units/ha 274persons/ha	177units/ha 665persons/ha	504units/ha 185persons/ha
Floor Area Ratio	67%	76%	-	77%	Mid-rise72% High-rise121%	92%	143%	137%	130%	-
Building Cover-age Ratio	11%	19%	-	17%	Mid-rise층15% High-rise 9%	16%	14%	12%	-	-
site area(m ²)	46,747	87,174	111,138	554,155	1,388,020	1,241,784	2,038,073	727,276	1,774,243	19,675,273
No. of Units	642	1,132	1,584	3,784	19,180	14,208	26,629	5,476	30,800	97,500
No. of Floors	6	5	12	5	5,15	3-15	5-20	6-24	5-25	5-30
Pyeong type	9,12,15,16	12,15,17,20	18,24,26,28	22-64	7.5-36	7.5-45	18-57	25-64	11-38	12-79
Layout of Rooms	16 Pyeong 2LKB	15 Pyeong 2LKB	18 Pyeong 2LD-KB	22 Pyeong 3LD-KB	17 Pyeong 3LKB	16 Pyeong 2D-KB	20 Pyeong 2LD-KB	25 Pyeong 2LD-KB	20 Pyeong 4D-KB	22 Pyeong 2LD-KB
No. of Bay	Front 2Bay Back 3Bay	Front 2Bay Back 2Bay	Front 2Bay Back 2Bay	Front 2Bay Back 4Bay	Front 2Bay Back 3Bay	Front 2Bay	Front 2Bay Back 2Bay	Front 2Bay Back 2Bay	Front 2Bay Back 2Bay	Front 2Bay Back 2Bay

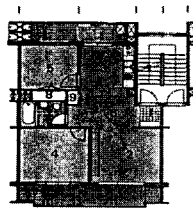
(4) analysis of the unit plans in the 1990s

In the 17-pyeong type apartment of Bundang, each housing unit can be accessed through a staircase. Bedroom-1, bedroom-2, and bathroom can be accessed from kitchen and diningroom. There is a balcony on the front side of bedroom-1, and a service balcony on the kitchen side. To use a small pyeong type more efficiently, only an essential circulation zone is planned, and a small, extra space is used as a storage room as in Olympic Athlete's Apartment.

The 22-pyeong type also uses a staircase instead of a corridor; and this is another characteristic of the pyeong type in the 1990s. When entering the porch from the staircase, there is a relatively wide hall, which divides the kitchen area and the livingroom area. To increase the usability of inner space, both back and front balconies are provided.<Table 13>



17-pyeong Type



22-pyeong Type

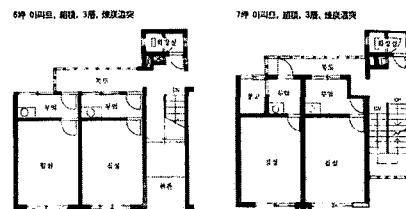
<Figure 17> Bundang APT

No peculiar pyeong type has been introduced in the areas of Ilsan, Sanbon, or Pyeonchon. Compared with the apartments in the 1980s, a more detailed and useful inner space is planned, but the plan types for each pyeong are turned out to be noncharacteristic.

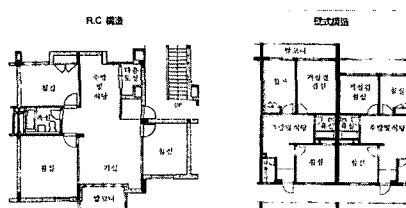
4.2. Analysis of A Method of Equipment and Structure

With rapid industrialization, the system of heating equipment could modernize the housing styles of Korea. Mapo Apartment was the first apartment that had adopted the individual water heating system, using the coal briquette boiler changed from the old coal briquette floor-heating system. This kind of coal boiler was an important heating

method until the city gas heating system was introduced in Gwacheon New Town. Between the late 1970s and the early 1980s, by changing the coal briquette floor heating system to the coal briquette boiler or the oil boiler, the layout of rooms became less restrictive as the space for the coal furnace for traditional Korean floor heating system was no longer needed, which made it possible for combining the spaces of kitchen and livingroom. Mapo Apartment is the first apartment using the wall tube for telephone lines, the water meter, and the water & power transformer. The flush toilet also was first introduced in Mapo Apartment. Each housing unit of Mapo Apartment was equipped with an individual flush toilet; whereas other existing apartments used public restrooms that were placed outside the housing units. Even in old YoungDan Housing, the toilet room was inside each housing unit, but the traditional toilet room was seldom used due to sanitary problems, so there was also a toilet room outside the housing unit. Improvement of the heating and cooking methods as well as the sanitary facilities are important factors, which have allowed an effective use of unit plan and introduced a modern housing environment.



<Figure 18> Equipment System of Mapo Apt



<Figure 19> Changes of the Structure System

The planning of collective housing has been developed by the advancement of building materials, construction method, and the system and material of

equipment. Wood or mud bricks were used as a construction material until the 1950s. As cement was mass produced from 1958, houses with cement brick structure or cement block structure lower than 3 stories were built. In 1962, the reinforced concrete (R.C.) structure became popular from the construction of Mapo Apartment. Since then, the R.C. structure has become the main driver for the development of mid-rise housing in the 1970s. During the 1980s, various types of high-rise housing was developed to increase the effective use of land. Furthermore, as demand for housing was drastically increased, the foundation of a mass construction system was developed to meet the housing demand, and the methods of design and construction were improved for quality housing. At that time, high-strength steel was used to reduce the thickness of structure. From the 1980s, the sheer wall structure was finally introduced. To improve the problems of the R.C. structure which uses a large space and steel for the columns and beams, the sheer wall structure was developed to replace the walls between housing units or the interior partitions with concrete walls. The sheer wall structure made it possible to lower the height of floors by changing from the double ceiling system to the single ceiling system. As a result, the construction cost was drastically reduced, and the aesthetics and the use of an inner space were increased because of unprotruded columns or beams. From the mid 1980s, a construction of high-rise apartments with more than 15 stories could be built with an introduction of an earthquake-proof design and an ultimate strength structural design. In Sanggey-dong, even 25-story super high-rise apartments were constructed. Since then, an application of the R.C. sheer wall structure to the constructions of collective housing became very common.

4.3. The System of Inner Space

The development of the heating system can be said to be the most important factor in structuring the inner space. From the 1960s to the 1970s, the most common heating system in Korea was the coal briquette floor-heating system even when the coal briquette boiler was used for Mapo Apartment. Because of the danger of gas poisoning, the kitchen and other rooms had to be separated. For this reason, the space of kitchen and livingroom was separated in Mapo Apartment, up until the construction of Hanggang Public Servant Apartment. When the safety of the coal

<Table 13> Analysis of the unit plan & Chronological Characteristics

		Diagram of Zoning system		
1960s	zoning			
		Mapo Apt	Hanggang Public Servant Apt	
	characteristics	<ul style="list-style-type: none"> • Complete separation of kitchen & livingroom • Low use of balcony - Lack of service area • Lack of separate storage space • Simple layout of rooms • Usually a corridor type • Both bathroom & kitchen located near the porch • Room division by the corridor - Long circulation space 		
1970s	zoning			
		Yeoyido Sibum Apt	Banpo Apt	Jamsil Apt
	characteristics	<ul style="list-style-type: none"> • Open kitchen & livingroom • Use of balcony as service space -In relation with a utility room • A centering function of livingroom • Coexistence of a corridor type and a staircase type • Consideration of a storage space • In relation with a utility room • Full blown western lifestyle 		
1980s	zoning			
		Gwacheon New Town	Mokdong New Town	
		Sanggye New Town	Olympic Athlete's Village Apt	
	characteristics	<ul style="list-style-type: none"> • Open kitchen & livingroom • Active use of a storage space • Balcony use in relation with a utility room as a service space • Adaption of a laundry room, besides bathroom • New layout of rooms for the consumer's needs • Various pyeong types • coexistence of a corridor and a staircase type • Obscure division of area • Reconsideration of space. 		
1990s	zoning			
		Bundang New Town (Ilisan New Town, Pyeongchon New Town, Sanbon New Town, etc.)		
	characteristics	<ul style="list-style-type: none"> • Open kitchen & livingroom • Acquisition of a laundry room • Removal of corridor withing a housing unit - Appearance of a small hall • Various/unique pyeong types • Active use of the back & front balcony • Spacious layout • Staircase type 		

briquette boiler was confirmed, the space of kitchen could be open to the livingroom from the construction of Yeoyido Sibum Apartment and Jamsil Apartment. From the late 1980s, as the public area was increased, and the private use area was decreased. As a result, the division of kitchen, diningroom, and livingroom became obscure. In the apartments of the 1960s, kitchen and bathroom were placed in the same zone and adjacent to the porch to reduce the

space for the equipment shaft. From the 1970s, the kitchen and the livingroom were not necessarily placed in the same zone, and their locations were determined by considering the increased usability of space. Most of the time, a balcony was placed on the front side of the livingroom and the master bedroom. From Banpo Apartment, the back balcony with a function of storage was placed in the service zone behind the kitchen. The need for a storage space was well incorporated when designing space from the late 1980s. This trend was to use a small extra space more usefully and to minimize unnecessary space. The laundry/storage space was placed in the balcony area. By using selves, a vertical use of space was attempted.

In terms of a chronological changes in the relation of rooms, the kitchen, the livingroom, and the bedrooms of a small plan type during the 1960s-1970s were designed as separate rooms with the partitions, and a wall was placed between kitchen and livingroom. However, as a western lifestyle was introduced, livingroom and kitchen were arranged in line to provide flexibility between the two rooms; a utility room was placed in the back balcony to help household work. An attempt was made to include such space in the kitchen area, and a room with a storage function was designed within a unit plan. The most peculiar characteristic of the small unit plan is that the sizes of rooms, except for a large livingroom and the master room, were designed small to place as many rooms as possible within a unit plan. However, with an improved housing style, the number of rooms was reduced, and a larger size of rooms were designed by considering the convenience of residents. This trend reflects the changes in family life, shifting from a couple-centered life style to a children-centered family life. Separate spaces of livingroom and kitchen were merged to form a flexible space without a partitioning wall, and new rooms such as a utility room and a storage room were placed to meet the needs of residents. To provide a more practical living space for family members, a more rational arrangement of rooms was attempted. A flexible type of apartments, where the size and number of rooms can be adjusted, was developed to reflect the preference and the need of residents. This plan was to accommodate various classes of residents within a limited area and to allow a flexible use of space according to the changes in the family structure. The characteristics of the inner space of such

apartments are presented in <Table 13>.

5. Conclusion

In the process of the modernization of Korea, population concentration in big cities has caused a serious shortage of housing. To resolve such an imminent housing problem, many apartments were constructed very actively, and now they have become the most popular type of housing.

In this study, the changes of housing culture were analyzed by focusing on the drastic development periods of housing. Based on the results of analyses, the following conclusions can be made:

- As the scale of plan got larger, the development of housing has grown to the size of a city. Due to a trend of building high-rise apartments, the building coverage ratio was maintained within a range of 10% even if the floor area ratio was increased.

- From many aspects, Mapo Apartment has first applied a modern apartment system. An introduction of the coal briquette boiler system and the flush toilet was the most revolutionary in the history of Korean housing.

- With the improvement of the heating system, kitchen in the 1960s was designed as a separate space, but from the 1970s, the areas of kitchen/diningroom and livingroom were divided.

- The R.C. structure used for the construction of Mapo Apartment was changed to the shear wall structure in the early 1980s. Since then, up until now, most apartments adopted the wall structure to reduce the construction cost.

- Various floors and various types of plans have been developed, but a similar types of plan were used for each pyeong type

The analyses of this study show that apartment is the most popular type of collective housing in Korea. However, when constructing housing in an existing residential area of detached houses, a new type of housing should be developed by considering the context of a city that is already formed.

During a short history of collective housing in Korea, the solution of housing problems has been concentrated on resolving a housing shortage through a mass supply of housing. However, it is time to improve the quality of housing at the national level.

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