



Analysis of the Efficient Utilization of Surplus Parking Spaces in Apartment Complexes of Seoul

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ABSTRACT

Purpose: Residents in deteriorated residential areas of Seoul have suffered from parking shortage problem. Since it is almost impossible to supply new parking, it is critical to find a way to efficiently utilize existing parking spaces. This study proposes utilizing unused parking spaces in apartment complexes so that residents in multi-unit or multi-family houses can share those parking spaces. **Method:** Spatial scope of this research is limited to multiplex-clustered neighborhood and apartment complex in Seoul. To identify the nature of parking problem, we reviewed current parking situations in residential areas and policies from the Seoul Metropolitan Government. To understand the amount of parking spaces required to solve parking shortages in multiplex-clustered neighborhoods, this study analyzed car ownership per household and available parking spaces in old residential areas. Then we were able to apprehend the amount of parking spaces that could be used for residents in aged multiplex-clustered areas. **Result:** Our analysis shows a great potential to utilize surplus parking spaces from apartment complexes for solving parking problems in multiplex-clustered neighborhoods.

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KEYWORD

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1. Introduction

1.1. Background and Purpose of Study

Old multiplex-clustered neighborhoods in Seoul suffer from severe parking issues since these districts do not have enough parking spaces for all residents. Housing redevelopment projects used to be a way to solve the parking problem but projects are not progressing well except in some areas due to an economic recession. Therefore, the maintenance approach towards future old residential areas are most likely going to be achieved through small unit restoration type redevelopment. (Jang Nam-Jong et al., 2013).

In this situation, it is necessary to discover which parking spaces are already secured and which are inefficiently used and to consider measures to use them efficiently. Seoul Metropolitan Government supports opening privately owned parking lots at night for nearby residents to enable them to have parking spaces, which would be otherwise empty at night. This can be done through agreement among the parking lot owners, the administrative district, and the local residents. The government provides a variety of financial incentives for parking lot facility improvements, security facility construction and support, etc. to encourage owners to open their

parking lots to local residents(Lee Kwang-Hoon, 2013).

By using the surplus parking spaces of apartment complexes adjacent to multiplex-clustered neighborhoods, we are searching for a plan that could resolve the parking problems of the residential areas where it is difficult to secure additional parking spaces. In this study we are searching for a solution to this problem and we will examine the expected effects and results.

1.2. Scope and Method of Study

The spatial scope of this study was Seoul and the object of the study was limited to “parking demand generated by multiplex-clustered neighborhoods and apartment complexes”. This study reviewed the parking status and parking policies of Seoul and each administrative district and then pointed out their problems.

To identify how much apartment parking lots can share parking demand required for the multiplex-clustered neighborhoods, we estimated parking demand by calculating the parking space per household of multiplex houses and the number of parking spaces. Thereafter, we reviewed total amount of sharing capacity by identifying the number of surplus parking spaces out of apartment parking spaces.

Overall parking status in Seoul was reviewed based on parking-related statistics of Seoul statistics¹⁾. The numbers of

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1) <http://stat.seoul.go.kr/>

passenger cars of multi-unit or multi-family houses and apartments by administrative district dong were calculated using sample data of 2010 household traffic diary survey. The numbers of apartment parking spaces per administrative district dong were estimated from parking space standards. The numbers of surplus parking space within apartments were calculated by the numbers of estimated parking spaces and passenger cars of households living in apartment complexes. Based on these estimated data, we reviewed countermeasure for solving parking problems and enforcement effect through utilizing surplus parking spaces.

2. Parking Status of Residential Areas in Seoul

2.1. Parking Spaces Status

Parking spaces in Seoul have steadily increased due to the increasing trend of cars. The number of cars in Seoul was 3,056,558 and the number of parking spaces was 3,877,326 at the end of 2015. The parking space rate²⁾ that represents the ratio of number of parking spaces compared to the number of registered cars was 126.9%. The parking space rate of the residential areas³⁾ was 100.3%, so the number of parking spaces of the residential areas⁴⁾ has exceeded the number of cars. Thus, numerically speaking, Seoul have solved the supply-demand imbalance to some extent.

Examining the ratio of parking space by parking space type, it shows that the annexed parking space ratio was at 93.7%, accounting for the majority of the total, whereas on-street parking space and off-street parking space was negligible at 3.5% and 2.8%, respectively. The annexed parking space of apartments occupies a majority at 50.4% of the total, and the annexed parking spaces of general buildings occupy a low share rate of 7.9%(Table 2).

2.2. Parking Space Status of Residential Areas by Autonomous District(Gu)

The total parking space rate of the residential areas in Seoul comes to 100.3% and thus seems to solve any shortage problems numerically. However, examining the parking space rates of the residential areas by autonomous districts, 9 autonomous districts out of 25 are less than 100%. What is more, autonomous districts where multiplex houses are clustered such as Seodaemun-gu (60.1%), Yeongdeungpo-gu (77.0%), Geumcheon-gu (80.5%), etc., demonstrate a serious shortage in parking spaces (Table 3).

2) Parking space rate (%) = number of parking spaces / number of registered cars × 100

3) Parking space rate of the residential areas = number of parking spaces of the residential areas / number of registered cars × 100

4) Parking space of the residential areas= on-street parking space (municipal) + off-street parking space (municipal) + annexed parking space (residential)

Table 1. Increase of Registered Cars and Parking Spaces

Contents		Year		
		2005	2010	2015
Number of Parking Space (A)	Total	2,759,689	3,404,346	3,877,326
	Residential Area	1,823,210	2,206,664	2,437,900
Number of Registered Cars (B)	Total	2,808,771	2,981,400	3,056,588
	Passenger Car	2,094,317	2,283,176	2,445,310
Parking Space Rate (A/B)	Total	98.3	114.2	126.9
	Residential Area	87.1	96.6	100.3

Source : Seoul Statistics (<http://stat.seoul.go.kr>), 2005, 2010, 2015

Table 2. Parking Space Types and Numbers

Type	Management or Ownership	Number of Parking Spaces	Percentage (%)	
On-street Parking Space	Seoul City	2,690	134,924	0.1
	Autonomous District(Gu)	132,234		3.4
Off-street Parking Space	Seoul City	15,357	109,306	0.4
	Autonomous District(Gu)	51,527		1.3
	Private Sector	42,422		1.1
Annexed Parking Space	House	307,301	3,633,096	7.9
	Apartment	1,954,248		50.4
	General Building	1,371,547		35.4
Total		3,877,326	100.0	

Source : Seoul Statistics (<http://stat.seoul.go.kr>), 2015

Table 3. Parking Space Statistics by Autonomous District(Gu)

Autonomous District (Gu)	Number of Registered Cars (A)*	Number of Registered Passenger Cars (B)**	Number of Parking Spaces (C)***	Number of Parking Spaces in Residential Area (D)****	Percentage of C/A (%)	Percentage of D/B (%)
Total	3,056,588	2,437,900	3,877,326	2,445,310	126.9	100.3
Dongdaemun	96,607	74,503	122,229	88,595	126.5	118.9
Eunpyeong	126,482	101,630	150,781	119,697	119.2	117.8
Seongbuk	116,543	95,678	149,216	112,222	128	117.3
Yongsan	76,078	64,104	110,751	72,296	145.6	112.8
Gangbuk	75,760	58,573	85,446	66,080	112.8	112.8
Dobong	95,851	74,536	108,858	83,032	113.6	111.4
Gangdong	137,662	109,595	161,648	121,305	117.4	110.7
Dongjak	102,067	87,129	134,621	93,775	131.9	107.6
Seocho	178,849	149,925	279,647	161,181	156.4	107.5
Gangseo	191,073	150,143	240,169	157,150	125.7	104.7
Gwanak	120,791	98,206	143,921	102,761	119.1	104.6
Jungnang	110,094	82,142	119,592	85,761	108.6	104.4
Songpa	218,941	180,550	277,008	185,080	126.5	102.5
Seongdong	95,767	74,727	116,675	75,903	121.8	101.6
Nowon	154,645	126,393	165,131	127,085	106.8	100.5
Mapo	116,917	93,932	166,646	94,310	142.5	100.4
Gwangjin	96,092	76,681	118,208	74,324	123	96.9
Yangcheon	149,720	120,734	157,006	110,524	104.9	91.5
Guro	138,272	105,652	158,538	96,055	114.7	90.9
Gangnam	244,784	198,610	379,400	180,621	155	90.9
Jongno	49,815	37,256	86,478	31,461	173.6	84.4
Jung	52,988	39,106	107,313	31,918	202.5	81.6
Geumcheon	82,684	59,483	111,803	47,905	135.2	80.5
Yeongdeungpo	145,778	112,172	160,643	86,359	110.2	77.0
Seodaemun	82,328	66,440	65,598	39,910	79.7	60.1

Source : Seoul Statistics (<http://stat.seoul.go.kr>), 2015

In regards to the city center, the total amount of parking space rate and the parking space rate of the residential area shows a large deviation. The parking space rate of Jung-gu and Jongno-gu represent 202.5%, 173.6% respectively, representing the highest parking space rate in Seoul. But the parking space rate of the residential area is only 81.6%, 84.4% respectively, and therefore low in rank. This means that parking space for business in city center has been sufficiently secured by recent large-scaled developments of new business facilities. However, even the same autonomous districts still suffer from parking difficulties in residential areas. Even in the positive case of Gangnam-gu, of which the parking space rate is 155%, the residential areas are facing a parking space shortage phenomenon, as the parking space rate of the residential area has only reached 90.9%.

2.3. Parking Policies for Solving Parking Problem of Residential Area

Seoul Metropolitan Government has enforced various parking supply policies, such as a Residential Parking Permit Program, the Green Parking Project, co-parking space construction in residential area, school underground parking spaces, etc. to try and resolve the parking space shortage problems of residential areas.

The Residential Parking Permit Program is a system that allows street parking by installing parking spaces on the road that has been developed since 1996. It is a typical policy to secure parking space in old residential areas, by devoting a parking space on parts of the road, and was operating with 131,346 spaces at the end of July, 2012. It can secure parking spaces without additional land purchase because it utilizes public roads. Since it adversely affects traffic flow and worsens walking conditions, it cannot be the only answer for solving the fundamental traffic problems of old residential areas. Utilization of systems using GIS for the efficient management of the program has been proposed (Lee Keun-Hee et al., 2000, Kim Si-Gon et al., 2002). This is being enhanced by a parking sharing system; empty residential permit parking is known by an Autonomous District and people with smart phones can know when a parking space is available through the parking information exchange.

Green Parking Project enforced from 2004 is the measure to secure parking spaces by breaking down the walls of the house. 48,867 of parking spaces were secured by participation of 24,747 houses on the end of 2014. It may secure parking spaces at relatively low cost owing to utilizing private space. Since there are limitations to inducing participation of landowners, the project results has decreased year by year. To activate the green parking program, diversification of plan and support of self-management system have been proposed (Shin Jung-in et al., 2011).

Co-parking space construction in residential areas is a project where Seoul Metropolitan Government buys land and creates parking spaces for residential areas with poor parking environments; securing 14,742 spaces at 176 locations by 2014. However, because this is through the creation of new sites, there has been difficulty in both raising funds and securing sites. Creating parking through utilization of school playgrounds or parks is a mixed use of public facilities; parking spaces utilizing school playgrounds secured 3,790 spaces at 28 locations and underground parking spaces utilizing parks, etc. secured 5,245 spaces at 28 locations by 2014. It has the advantage of reducing costs by utilizing existing sites, but problems arose in terms of safety and accessibility (Kim, Yun-Sun et al., 2012).

Using the annexed parking spaces of buildings, schools, churches, etc. during the night created 4,165⁵⁾ spaces at 133 locations in 2012. If it is too difficult to create new parking spaces, this may be the best way in terms of efficiency because it utilizes the surplus parking areas during a certain time period without actually having to create additional parking spaces. However, landowners are reluctant to participate in the program with the reasons such as parking space shortage of existing users, no observance of leaving time, etc.

Current ongoing policy projects can be achieved to some degree in the short period in terms of securing parking spaces. However, new parking space expansion to solve parking space shortages in residential areas is not easy. From this viewpoint this study is searching for the possibility of solving the parking problem of residential areas, by reviewing the parking space capacity of apartments, and the parking demand, and then identifying and assessing the number surplus parking spaces.

3. Parking Status of Multiplex-clustered Neighborhoods

3.1. Parking Status of Passenger Cars per Households of Multi-unit or Multi-family Houses

To identify the parking status of multiplex-clustered neighborhood, the rate of passenger cars per households of multi-unit or multi-family houses⁶⁾ by Administrative Districts ‘Dong’ was calculated from the sample data of a 2010 Household Travel Diary Survey. The rate of passenger cars per households is less than 0.7 at 91.3% of total administrative district ‘dongs’. Administrative District ‘Dongs’ in excess of 0.7 are 37 ‘dongs’

5) Registered parking spaces in the Facilities Management Corporation by parking co-use policies

6) The rate of passenger cars per households of multi-unit or multi-family houses = the number of sample passenger cars per households of multi-unit or multi-family houses by administrative district ‘dong’ / the number of sample households of multi-unit or multi-family houses

located in Gangnam-gu, Seocho-gu, and Songpa-gu(Table 4).

Table 4. Passenger Cars per Households of Multi-unit or Multi-family Houses

Average of Passenger Cars per Households of Multi-unit or Multi-family Houses	Number of Administrative District (Dong)	Percentage (%)
0.5 or below	180	42.5
0.5 to 0.7	207	48.8
0.7 to 0.9	36	8.5
0.9 to 1.1	1	0.2
Total	424	100.0

Source : 2010 Household Travel Diary Survey (2011)

Based on the average number of passenger cars per household, the number of passenger cars owned by households of multi-unit or multi-family houses were estimated by administrative districts ‘dong’. The number of administrative districts ‘dong’ of 1,000 or less was 147, accounting for 34.7%, and above 1000 and 3,000 or less, accounting for a majority of 46.7% of 198. The number of administrative districts ‘dong’ of above 3,000 and 5,000 or less was 66, 15.6% and above 5,000 was 13, 3.1%. Figure 1 shows the spatial distribution of the number of passenger cars per household of multi-unit or multi-family houses by administrative districts ‘dong’(Table 5).

Table 5. Number of Passenger Cars Owned by Households of Multi-unit or Multi-family Houses

Number of Passenger Cars	Number of Administrative District (Dong)	Percentage (%)
1,000 or below	147	34.7
1,000 to 2,000	102	24.0
2,000 to 3,000	96	22.7
3,000 to 4,000	41	9.7
4,000 to 5,000	25	5.9
above 5,000	13	3.1
Total	424	100.0

Source : 2010 Household Travel Diary Survey (2011)

3.2. Parking Sharing Status of Residential Parking Permit Program

If annexed parking spaces are not secured within multiplex houses, residents have no choice but to depend on external parking spaces. In these cases the Residential Parking Permit Program (RPPP) is utilized as a typical substitute to create parking spaces; to calculate its parking sharing capabilities the ratio of parking spaces of the RPPP was compared with the number of passenger cars per households of multi-unit or multi-family houses by administrative districts ‘dong’.

In 212 ‘dongs’ which occupy 50.0% of administrative districts ‘dong’ parking spaces of the RPPP can share up to 20% of the parking demand of households of multi-unit or multi-family houses. Administrative districts ‘dong’ capable of sharing more than 40% were 63 dongs(14.9%), and administrative districts ‘dong’ capable of sharing more than 80% were 23 dongs (5.4%) (Table 6). When looking into the sharing rate, the RPPP covers some portion of parking demand for residential areas, but it cannot cover the whole parking demand, confirming the need to require alternative parking spaces.

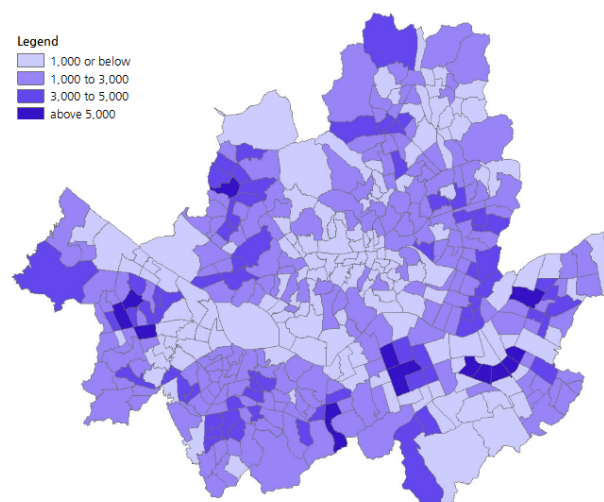


Figure 1. Number of Passenger Cars of Multi-user or Multi-family Households by Administrative District ‘Dong’ in Seoul

Table 6. Parking Spaces of RPPP* by Required Parking Spaces of Multiplex Houses

Range	Number of Administrative District (Dong)	Percentage (%)
No RPPP	47	11.1
20 or below	212	50.0
20 to 40	102	24.1
40 to 60	30	7.1
60 to 80	10	2.4
above 80	23	5.4
Total	424	100.0

Source : Seoul Metropolitan Government

* Residential Parking Permit Program

4. Parking Status of Apartment Complex

4.1. Parking Status of Passenger Cars per Households of Apartment Complex

The rate of passenger cars per apartment households by administrative district ‘dong’ 7) was calculated by utilizing the

7) The rate of passenger cars per apartment households = the number of sample

sample data of a 2010 Household Travel Diary Survey. As a result, the rate of less than 0.7 was low by 12.2%, and household owning 0.9 to 1.1 accounted for the majority at 47.6%. It is in contrasts with 91.3% of less than 0.7 cars in the case of households of multi-unit or multi-family houses. The number of administrative district ‘dong’ of over 1.1 cars per household was 58, accounting for 13.7% of the total, with the majority concentrated in the Gangnam area.

Table 7. Passenger Car per Apartment Households

Average Number of Passenger Car per Household	Number of Administrative District (Dong)	Percentage (%)
0.5 or below	18	4.2
0.5 to 0.7	34	8.0
0.7 to 0.9	112	26.4
0.9 to 1.1	202	47.6
above 1.1	58	13.7
Total	424	100.0

Source : 2010 Household Travel Diary Survey (2011)

The number of passenger cars by apartment complexes by administrative districts ‘dong’ was estimated out of the average rate of passenger cars per apartment households. The number of administrative districts ‘dong’ of 1,000 or less was 122, accounting for 28.8%. The number of administrative district ‘dongs’ of over 5,000 accounted for 25.9% of the total, showing that only 3.1% of administrative districts ‘dong’ satisfied the conditions at multi-unit or multi-family houses.

Table 8. Number of Passenger Cars of Apartment Households

Number of Passenger Cars	Number of Administrative District (Dong)	Percentage (%)
1,000 or below	122	28.8
1,000 to 2,000	67	15.8
2,000 to 3,000	56	13.2
3,000 to 4,000	43	10.1
4,000 to 5,000	26	6.1
above 5,000	110	25.9
Total	424	100.0

Source : 2010 Household Travel Diary Survey (2011)

4.2. Scale of Surplus Parking Spaces of Apartments

A 2010 Household Travel Diary Survey dataset was used to get an idea of the scale of surplus parking spaces at apartments . After identifying legal parking spaces by applying parking space installation standards,⁸⁾ the parking spaces except for the number of passenger cars owned by apartment households was estimated to extract the ‘number of surplus parking spaces available from

passenger cars per apartment households by administrative districts ‘dong’ / the number of sample households of apartments

8) Stipulated in Article 27 paragraph 1 No. 1. of “Regulations Regarding Housing Construction Standards, etc.”

apartments.’⁹⁾

Table 9. Surplus Parking Spaces of Apartments in Seoul

Number of Surplus Parking Spaces	Number of Administrative District (Dong)	Percentage (%)
500 or below	196	46.2
100 or below	70	16.5
100 to 200	38	9.0
200 to 300	29	6.8
300 to 400	36	8.5
400 to 500	23	5.4
500 to 1,000	89	21.0
1,000 to 2,000	99	23.3
2,000 to 3,000	26	6.1
3,000 to 5,000	11	2.6
above 5,000	3	0.7
Total	424	100.0

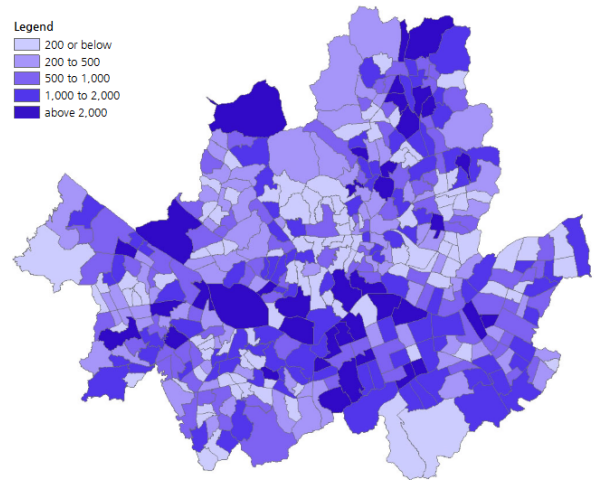


Figure 2. Number of Surplus Parking Spaces in Apartments by Administrative District ‘Dong’ in Seoul

It is estimated that 32.8% of administrative district ‘dong’ in Seoul hold surplus apartment parking spaces of more than a 1,000. Given the reality that it generally secured more parking spaces than the legal standard it is expected that the ratio of administrative district ‘dong’ holding surplus parking spaces of more than 1,000 appears high.

5. Possibility of Sharing Surplus Parking Spaces of Apartments

5.1. Possible Sharing Ratio of Surplus Parking Spaces of Apartments

‘Possible sharing ratio’¹⁰⁾ was examined to review to what

9) the number of surplus parking spaces of apartments = legal parking spaces of apartments – the number of passenger cars of apartments

10) Possible sharing ratio = the number of surplus parking spaces of apartments ÷ the number of owned passenger cars of multi-unit or multi-family houses

degree the number of passenger cars of multi-unit or multi-family houses by administrative district ‘dong’ of Seoul could accommodate surplus parking spaces of apartments. This value means how much the ratio of surplus parking spaces of apartments can accommodate the passenger cars of multi-unit or multi-family houses.

The results showed that in the 154 administrative districts ‘dong’ (36.3%) of Seoul that the possible sharing ratio of surplus parking spaces attached to apartments was more than 50%. This means that more than 50% of passenger cars of multi-unit or multi-family houses could park in the surplus parking spaces of apartments. Meanwhile, it showed that in 104 administrative districts ‘dong’, more than 90% of those who passenger cars of multi-unit or multi-family houses could park in the surplus parking spaces of apartments.

Table 11 shows the aggregated results for the possible sharing ratio and the number of sharing parking spaces by each administrative district ‘dong’. The administrative districts ‘dong’ with low possible sharing ratios show a tendency to have a small number of shared parking spaces.

In the administrative districts ‘dong’ with high possible sharing ratios of between 80%~100%, the number of shared parking spaces is evenly distributed, which means that there are a large number of administrative districts ‘dong’ with a high possible sharing ratio and a large number of parking spaces to share. It shows that the administrative districts ‘dong’ with a number of shared parking spaces of more than 1,000 and a possible sharing ratio of 80-100% is 29. Administrative districts ‘dong’ with a possible sharing ratio of 80 or less but the number where shared parking spaces of 1,000 or more is 33.

If apartments have many surplus parking spaces to share for the parking demand of the nearby residential areas it can be a effective solution to solve the parking problem of multiplex clustered neighborhood.

Table 10. Possible Sharing Ratio of Surplus Parking Spaces in Seoul

Sharing Ratio (%)	Number of Administrative District (Dong)	Percentage (%)
10 or below	145	34.2
10 to 20	48	11.3
20 to 30	34	8.0
30 to 40	25	5.9
40 to 50	18	4.2
50 to 60	22	5.2
60 to 70	9	2.1
70 to 80	8	1.9
80 to 90	9	2.1
90 to 100	106	25.0
Total	424	100.0

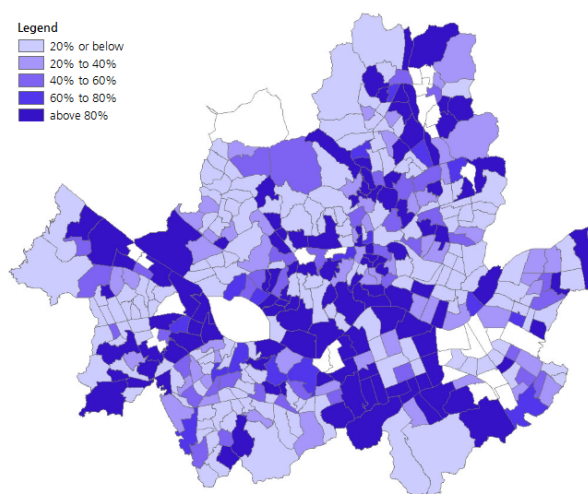


Figure 3. Possible Sharing Ratio of Surplus Parking Spaces by Administrative District ‘Dong’ in Seoul

Table 11. Possible Sharing Ratio & Number of Surplus Parking Spaces

(Unit : Administrative District ‘Dong’)

Sharing Ratio \ Number of Parking Spaces	0~20%	20~40%	40~60%	60~80%	80~100%	Total
0 to 100	93	1	1	1	19	115
100 to 200	34	3	-	-	8	45
200 to 300	26	1	-	1	11	39
300 to 400	16	12	5	-	6	39
400 to 600	18	14	2	2	20	56
600 to 800	5	12	8	2	14	41
800 to 1,000	1	8	9	1	8	27
1,000 to 1,500	-	8	10	7	18	43
1,500 to 2,000	-	-	5	3	6	14
above 2,000	-	-	-	-	5	5
Total	193	59	40	17	115	424

5.2. Sharing Promotion of Surplus Parking Spaces

The approach of sharing the surplus parking spaces of apartments can be a countermeasure to meet the parking shortage problems in residential areas when it is not easy to create new parking spaces. Night opening of annexed parking spaces such as schools, churches, buildings, etc. is reluctant to participate with the reasons such as concern about safety, parking space shortage of existing users, the difficulty of leaving car requirements, etc. and so it should be sought for the complementary measures to this problem.

Seoul Metropolitan Government is providing a variety of incentives when 5 or more parking spaces are opened in a general residential areas and parking environmental improvement districts, which also can apply to apartments. It is providing maximum 25 million won for parking facility installation such as gates, CCTV, planting, painting buildings, etc. and supporting up to annual

maximum 20 million won through 1:1 matching support for parking operating profit. In addition, in case of opening to extend the contract period of more than 2 years, it is assisting maximum 5 million won for facility maintenance and repair and supporting parking liability insurance.¹¹⁾

By utilizing these systems, they can participate in the project without having to endure the burden of facility expansion because security facilities, reinforcement and maintenance costs are supported. On the other hand, if the parking fee is allowed to reflect the market value of the area, voluntarily participations will be expected. Strategic promotion of model cases can lay the foundations to expand participations if the positive results achieved.

6. Conclusion

Since old multiplex-clustered neighborhoods of Seoul find it difficult to secure new parking spaces, there is a difficulty in solving the parking shortage problem of the residential areas. On the other hand, apartments have secured surplus parking spaces by parking space installation standards in addition to parking spaces used by residents. Therefore, if these surplus parking spaces at apartments can be utilized effectively, it is possible to partly solve the parking problem of neighboring residences.

If the countermeasures are sought to utilize existing parking space so that demand and supply of parking space can be balanced in aspects of total amount, the solution can efficiently cope with the parking problems without having to supply additional parking spaces. Night opening of annexed parking spaces is an effective way of resolving the parking problems of residential areas by sharing the parking spaces empty at night with nearby residents. If the scope of the annex parking space is expanded into surplus parking spaces of apartments, it is expected to have an even greater positive impact.

In practical terms, the biggest obstacle for utilizing the surplus parking spaces at apartments is that the apartment's inhabitants have a negative perception to the parking space being opened up. In the current system apartments are sold as a bundle with a parking space, which cause a reluctance to share private property and an anxiety about safety due to outsiders access to property next to a resident's apartment. Therefore, even if opening up the surplus parking spaces, it should be sought to support the costs to ensure safety and to devise parking fee autonomously depending on local conditions in order to secure sufficient operating revenues. In addition, through staffing or support for public professional management, the system that connects the surplus parking spaces

and consumer is required. It should also be reviewed to apply sufficient incentive in policy to encourage active participation for serious parking problem region.

For the efficient utilization of the surplus parking spaces of apartments, 'parking separated sale system' separating parking space sale and housing sale (unbundled parking) can be regarded as a new policy. The concept of separated ownership of parking space and housing can make it easier to sell or rent surplus parking spaces of apartments to adjacent residential area, and the owner of housing has the advantage of reducing costs for unused parking space.

This study reviewed the possibility of utilizing the surplus parking spaces of apartments through the analysis of the total amount of administrative districts 'dong' unit by analyzing the relevant parking statistics. If reflecting realistic conditions such as convenience and accessibility of actual parking consumer, consent of apartment residents, etc., actually usable surplus parking spaces of apartments can be extremely limited. Therefore, for the areas with serious parking problem, the analysis reflecting actual status through scrutiny is required.

Acknowledgement

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