

A Study on the Post Occupancy Evaluation in Support of Residential Renovation for the Disabled

Kyoo-Il Lee and Young-Hwan Lee

Abstract—This study analyzes the effects according to disability type, renovation space, and indoor living style through the post-occupancy evaluation of households supported by home renovation, focusing on the indoor living type rather than the renovation method limited to the existing home renovation according to the disability type. The purpose of this study is to make efficient use of public goods of the government by proposing detailed standards factors to consider when selecting facilities in outdoor space supported by home renovation. The field survey was practiced on 105 residents who supported by Seoul Government. In access path, which is the only outdoor space in the residential environment, it is necessary to install safety grab bar remove floor-level changes.

Index Terms—POE, residential environment, renovation, barrier-free, the disabled.

I. INTRODUCTION

A. Background and Objectives of the Study

The number of people with disabilities registered in Korea is 2.5 million as of 2014, showing a steady growth rate since 2005. People with acquired disabilities, who account for the majority of the total disabled persons, experience discomfort due to the disability in the house where they have lived comfortably since the acquisition of a disability, and occasionally they found the basic life is difficult due to obstacles in the house[1]. In those cases, most people with disabilities want to stay in their own homes without moving out of their homes or entering a facility for the disabled or moving to a new home [2]. Considering this situation, it is essential to renovate the house where the disabled currently resides in response to the disability of the resident.

However, the research of general economic condition of the household with disabilities shows that the households with the monthly average income of 500,000 won to 990,000 won were estimated to be 20.7%, which is the highest. This means that the ratio of the household income to household income of general urban workers is 48.5%, which is very low compared to the income of the non-disabled people [3]. Therefore, the government and private organizations are implementing welfare support services to support the home renovations by changing the welfare system, which had been supporting only a part of the budget, in consideration of the reality such as the economic situation of the disabled.

However, since the public resources for the reconstruction of such homes for the disabled must be supported only for limited households, the economic aspect should be considered [4]. Therefore, in the case of home renovations supported by public support, the evaluation should be made on individual households with disabilities based on objective criteria, and then the support should be provided so as to maximize the effect [5].

Therefore, this study analyzes the effects according to disability type, renovation space, and indoor living style through the post-occupancy evaluation of households supported by home renovation, focusing on the indoor living type rather than the renovation method limited to the existing home renovation according to the disability type. The purpose of this study is to make efficient use of public goods of the government by proposing detailed standards factors to consider when selecting facilities supported by home renovation.

B. Research Methods and Scope

This study analyzes 105 households for post-occupancy evaluation which was supported by home renovation by the Seoul Metropolitan Government in 2014. Analysis was conducted on 105 households in 2014 to determine whether there is a difference in lifestyle, type of disability, and satisfaction by housing type. An Independent Samples t Test and one-way analysis of variance (ANOVA) were conducted to analyze changes in renovation needs.

The spatial range of this study is two spaces including access route, entrance where housing reconstruction has actually been done, to be investigated and analyzed.

In addition, for the purpose of classifying the way of using and living type of the disabled in the residential space, disability types were classified into nine categories and indoor living types six categories for households supported with home renovation to analyze support cases.

II. OUTLINE OF THE SURVEY

A. Characteristics of Households Surveyed

The distribution of the gender of the home improvement support target group showed that 61 (58.10%) were male and 44 (41.90%) were female, with male ratio slightly higher. In terms of the distribution by age group, people in their 60s or older were 45 (42.86%), which was the highest, followed by 21 people in their 40s (20.00%) and 19 people in their 50s (18.10%).

Analysis of the distribution by type of disability showed that the distribution of subjects with physical disabilities

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was large, with 45 (42.86%) being the most frequent disability disorder, followed by 23 (21.90%). In particular, 12 people with two or more disabilities provided with the support accounted for 11.43% of the total target. Among the people with two or more disabilities, people having brain lesion disorder, auditory disorder, and visual disorder at the same time accounted for the largest number of households; a plan was made to provide customized remodeling support considering not only physical disabilities but also multiple obstacles for such targets. Then, the remodeling support was provided in the order of eight people with auditory disorder (7.62%), seven people with intellectual disorder (6.67%), and three people with visual and mental disorders (2.86%), respectively.

TABLE I: CHARACTERISTICS OF TARGET GROUP

Classification		f	%
Gender	Male	61	58.1
	Female	44	41.9
	Sum	105	100
Age	10s	8	7.62
	20s	4	3.81
	30s	8	7.62
	40s	21	20
	50s	19	18.1
	60s or older	45	42.86
Sum		105	100
Disability type	epilepsy	1	0.95
	brain lesion disorder	23	21.9
	visual disorder	3	2.86
	kidney disorder	2	1.9
	autism	1	0.95
	mental disorder	3	2.86
	multiple disabilities	12	11.43
	intellectual disorder	7	6.67
	physical disability	45	42.86
	auditory disorder	8	7.62
Sum		105	100
Wheelchair User	User	21	20
	Non-User	84	80
Sum		105	100

The total of 21 households (20.00%) among the renovation support target households were using wheelchairs indoors.

Finally, the results of the analysis according to the classification of indoor lifestyles of people with disabilities are shown in Table II below.

According to the classification of indoor lifestyle, 30 disabled people, which is 28.57% of the total, could walk indoors with an assistant and 21 disabled people moved and lived using wheelchairs inside the house. In addition, 20 people with disabilities, which is 19.05%, moved and lived inside the house using walking aids such as a clutch. Specifically, when performing an analysis in connection with the degree of disability and lifestyle, the disabled with the highest level of disability use a wheelchair to move around indoors. It is analyzed that 20 out of 21 people using the wheelchair have the first or second degree of disability, showing that most targets are severely disabled. The people with the first and second degree of disability, who live and move around with an assistant accompanied, constituted about more than 82%.

TABLE II: CHARACTERISTICS OF INDOOR LIFE STYLE OF SURVEY TARGET

Classification	f	%	Disability Grade	f	% within	% of total
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Unaccompanied walk	15	14.29	1	4	26.67	3.81	
			2	6	40	5.71	
			3	3	20	2.86	
			4	2	13.33	1.9	
			Sum	15	100	-	
Clutch use	20	19.05	1	12	60	11.43	
			2	6	30	5.71	
			3	-	0	0	
			4	2	10	1.9	
			Sum	20	100	-	
Sedentary	17	16.19	1	11	64.71	10.48	
			2	6	35.29	5.71	
			3	-	0	0	
			4	-	0	0	
			Sum	17	100	-	
Wheelchair use	21	20	1	16	76.19	15.24	
			2	4	19.05	3.81	
			3	-	0	0	
			4	1	4.76	0.95	
			Sum	21	100	-	
Assistant accompanied walk	30	28.57	1	14	46.67	13.33	
			2	11	36.67	10.48	
			3	4	13.33	3.81	
			4	1	3.33	0.95	
			Sum	30	100	-	
Bedridden	2	1.9	1	2	100	1.9	
			2	-	0	0	
			3	-	0	0	
			4	-	0	0	
			Sum	2	100	-	
Sum		105	100	Sum	105	-	100

A. Characteristics of Housing for Renovation

In the case of households for the housing renovation support by the Seoul Metropolitan Government, the ratio of applicants for the renovation support who live in rental apartments and rental housing is higher than that of general households since in general the support is provided to low-income households.

Approximately 60% of the total households provided with the renovation are living in apartments, and most of them are living in SH and LH rental apartments.

Then, 23 households and 16 households of people with the disability were living in multi-family housing and multi-household housing, respectively. Next, the result of the survey on the type of home ownership shows that the households owning the house was five (4.76%), and the households renting a house with monthly rent or deposit were sixteen (15.24%). Just as the percentage of rental apartments is high, in terms of ownership of the housing, 78 households, the highest ratio of 74.29% of the total households that received the support were living in a rented house, and six households (5.71%) of category Others (such as houses of relatives or friends) received the support.

III. SATISFACTION ANALYSIS BEFORE HOUSING RENOVATION SUPPORT

A. General Satisfaction before Housing Renovation

The questionnaire survey was conducted to identify the degree of inconvenience the disabled people have to live in the housing before the home renovation support. And the degrees of satisfaction with housing by space and disability type were surveyed on the scale of 10. The results of the

survey are shown in Table III.

TABLE III: SATISFACTION BEFORE HOUSING RENOVATION

Classification		f	Satisfaction	Deviation
Gender	Male	61	2.08	1.37
	Female	44	1.84	1.20
Sum		105	1.96	1.29
Age	10s	8	2.25	1.30
	20s	4	1.50	0.87
	30s	8	1.00	0
	40s	21	1.67	0.94
	50s	19	2.53	1.31
60s or older		45	2.07	1.45
Sum		105	1.68	0.87
Disability type	epilepsy	1	1.00	0
	brain lesion disorder	23	2.04	1.40
	visual disorder	3	1.00	0
	kidney disorder	2	2.50	1.50
	autism	1	1.00	0
	mental disorder	3	2.00	0.82
	multiple disabilities	12	2.50	1.50
	intellectual disorder	7	1.86	0.99
	physical disability	45	1.89	1.22
auditory disorder	8	2.13	1.54	
Sum		105	1.72	0.75
Wheelchair User	User	21	1.90	1.38
	Non-User	84	2.00	1.29
Sum		105	1.96	1.25

The survey asked respondents to rate the satisfaction before the housing renovation support. The respondents gave 1 point if they felt the most uncomfortable, and 10 points if they felt no inconvenience at all. The average satisfaction score before the housing renovation support of 105 households was 1.98 points, which shows that the respondents felt very uncomfortable for daily life.

According to the specific analysis of satisfaction by gender, males gave 2.08 and females 1.84, showing females suffered more inconvenience. This is because the range of activities of women in housing is wider than that of men and the range of satisfaction survey is wider than that of men.

Next, the analysis of satisfaction by age shows that the satisfaction level of 20s, 30s, and 40s were 1.50, 1.00, and 1.67 points, respectively, which was lower than the overall average satisfaction. This suggests that the demand for housing is high in the age group with high activity level in the house; it was found that the greatest number of opinions are adjusted and the demand for the modification is the highest among the age group.

According to the results of the satisfaction survey by disability type, the average satisfaction level of people with physical disabilities, which accounts for the largest number of households to be renovated, scored 1.89, around the average satisfaction level in general. In the case of people with brain lesion disorder, the average score was 2.04, which is slightly higher than the average satisfaction level. The satisfaction distribution by disability type showed a uniform variation of 0.90 overall, and it was found that all the households had a low level of satisfaction with housing. Finally, in the case of the people using wheelchairs, the satisfaction level of the housing was 1.90, which shows that the satisfaction level of the housing was lower than that of the disabled who do not use wheelchairs.

B. Outdoor Space Satisfaction Analysis Before Housing Renovation

When the satisfaction of the housing for the disabled is examined, the overall score is 2.00 or less. However, the actual satisfaction of the disabled person in the individual space may be different from each other. Therefore, this study sought to collect the opinions of disabled people in general about the housing through satisfaction survey by space and indoor lifestyle.

The satisfaction level of the housing space is 1.60, which is very low. It can be seen that the satisfaction level of other spaces and bathroom spaces are very low at 1.07 and 1.27. The reason why the satisfaction of other spaces is low is that in the case of other spaces where there are not many renovation items, the desire of the target disabled for remodeling is clear and the image of the further improvement of the remodeling is often figured in the mind of the disabled in advance, which leads to lower satisfaction level than other spaces. On the other hand, bathrooms showed low satisfaction level, since they are connected with the actual life of people with disabilities, such as self-reliance, and in many cases, the disabled practically cannot use them at all.

TABLE IV: SATISFACTION ANALYSIS BEFORE HOUSING RENOVATION

Space	f	Satisfaction	Deviation
Access Road	16	1.44	0.61
Entrance	69	1.51	0.73

Table V shows the satisfaction level of the residential space according to the type of disability that was supported with the renovation. When the satisfaction level of the residential space was divided according to disability types, it was found that only the bathrooms showed a significant difference in satisfaction according to the type of disability. This means that the degree of discomfort in the use of the bathroom was reflected in the satisfaction level in accordance with the physical disability. The result of the surveyed satisfaction shows that the satisfaction of the people with brain lesion disorder and with the physical disability is generally very low in all the spaces. This seems to result from the fact in the case of people with brain lesion disorder or physical disability, the satisfaction level of the patients with physical disabilities is higher than other types of disabilities.

In the case of access roads, renovation support for three disability types was provided. Even people with intellectual disabilities, as well as people with brain lesion disorder or physical disabilities, gave 1.0 points of the satisfaction level, which is very low. The entrance was remodeled in accordance with a total of nine disability types with an average satisfaction of 1.82 points. The satisfaction with entrance also showed low scores among people with physical disabilities and brain lesion disabilities, and people with multiple disabilities showed a lower score than average satisfaction (1.57 points).

TABLE V: COMPARISON OF SATISFACTION

Classification	Disability Type	f	Satisfaction	Deviation
Access	brain lesion disorder	8	1.50	0.71

Road	intellectual disorder	2	1.00	0
	physical disability	6	1.50	0.50
sum		16	1.33	-
Entrance	epilepsy	1	2.00	0
	brain lesion disorder	15	1.40	0.49
	visual disorder	3	2.00	0.82
	kidney disorder	1	1.00	0
	autism	1	1.00	0
	multiple disabilities	7	1.57	0.90
	intellectual disorder	2	3.00	1.00
	physical disability	33	1.42	0.65
	auditory disorder	6	3.00	0
sum		69	1.82	-

C. Satisfaction Analysis by Lifestyle before Housing Renovation

Satisfaction with space according to the lifestyle produced the results different from other satisfaction survey. The satisfaction survey of the access route shows that the disabled people using the walking aids such as clutches and the disabled who can walk alone were less satisfied than the disabled living in other lifestyles. It is deemed that the reason for this result was due to the fact that more active outcome of satisfaction was presented among the types of lifestyles that have a higher activity level than the disabled living other lifestyles.

Unlike the access road, the satisfaction level of the entrance among the disabled who can walk alone was higher. The results of this study show that the disabled who can walk alone easily pass over obstacle such as the step of the entrance, and if the disabled can use both hands, they are most likely to remove obstacles and move by themselves.

TABLE VI: SATISFACTION ANALYSIS BY LIFESTYLE BEFORE HOUSING RENOVATION

Classification	Indoor Lifestyle	f	Satisfaction	Deviation
Access Road	Unaccompanied walk	3	1.33	0.47
	Clutch use	3	1.33	0.47
	Sedentary	1	1.00	0
	Wheelchair use	4	1.50	0.87
	Assistant accompanied walk	5	1.60	0.49
	Bedridden	-	-	-
	Entrance	Unaccompanied walk	11	2.09
Clutch use		13	1.38	0.62
Sedentary		11	1.55	0.78
Wheelchair use		13	1.23	0.42
Assistant accompanied walk		19	1.68	0.80
Bedridden		2	1.50	0.50

However, it was found that the degree of satisfaction was very low for disabled people using wheelchairs and people using clutches. The reason for this is that people using

wheelchairs or clutches require a relatively large entrance space compared to other disabled people.

IV. SATISFACTION ANALYSIS AFTER HOUSING RENOVATION

A. General Satisfaction after Housing Renovation Support

The satisfaction of housing of the disabled after the housing renovation support showed that the average of the overall satisfaction in the housing increased greatly. Overall satisfaction of housing renovation support was surveyed twice, and the first satisfaction survey was carried out once within one month after remodeling, and the second was undertaken three to four months after the disabled actually lived in the housing after the renovation so that the disabled person could reevaluate space. The first satisfaction survey was conducted through a written survey, and the second survey through both a written and a wired questionnaire.

TABLE VII: SATISFACTION AFTER HOUSING RENOVATION SUPPORT

Classification	A	Satisfaction		Deviation		
		①	②	①	②	
Gender	Male	2.08	9.36	7.36	1.01	1.40
	Female	1.84	9.02	7.22	1.00	1.38
Sum		1.96	9.19	7.29	1.00	1.39
Age	10s	2.25	9.13	7.25	0.99	1.34
	20s	1.50	8.50	6.50	1.00	1.34
	30s	1.00	8.88	7.38	0.99	1.38
	40s	1.67	9.33	7.61	1.04	1.34
	50s	2.53	9.42	7.19	1.02	1.38
	60s or older	2.07	9.24	7.31	1.01	1.41
Sum		1.84	9.08	7.21	1.01	1.37
Disability type	epilepsy	1.00	10	7	0	0
	brain lesion disorder	2.04	9.17	8.04	1.01	1.38
	visual disorder	1.00	9.33	6.33	1.01	1.29
	kidney disorder	2.50	9.50	6.50	0.76	1.37
	autism	1.00	9.00	6.00	0	0
	mental disorder	2.00	9.00	5.67	0.88	1.51
	multiple disabilities	2.50	9.41	7.41	1.01	1.39
	intellectual disorder	1.86	9.14	6.28	1.00	1.38
Wheelchair User	physical disability	1.89	9.29	7.49	1.00	1.38
	auditory disorder	2.13	8.63	6.25	1.01	1.32
	Sum	1.79	9.25	6.70	0.77	1.10
Non-User	User	1.90	9.33	8.14	1.00	1.38
	Non-User	2.00	9.19	7.06	1.02	1.41
Sum		1.95	9.26	7.60	1.01	1.40

(Satisfaction before Renovation, ①: Immediate Satisfaction after Renovation, ②: 4 month later Satisfaction after Renovation)

Satisfaction after the renovation of the house for the disabled was evenly improved in the overall target household, and it was found that they were generally satisfied with the life in the renovated housing after receiving the support. After about three to four months after the housing reconstruction, the second satisfaction survey was conducted through a written survey or a wired

questionnaire including telephone survey, and the satisfaction with the actual use was reexamined and some items were found to be somewhat low satisfactory.

According to the detailed analysis of satisfaction after reconstruction, the satisfaction by gender was 9.36 for males and 9.02 for females, which means the satisfaction of males was higher than females. In addition, the satisfaction of post-occupancy evaluation was also found to be higher in males than females.

In terms of the satisfaction level by age, it was found that the disabled people in their 40s had the most change in satisfaction and showed the highest level of satisfaction with the home improvement support. The disabled in their 20s and 30s were found to be the most dissatisfied with the housing before the remodeling, and they also showed the lowest satisfaction after the remodeling, which means that the disabled in the group have high demand for home renovations.

The results of the satisfaction survey by disability type showed that people with kidney or visual disabilities had the highest satisfaction after the renovation. However, when compared with satisfaction after residence which was 8.04 points for people with brain lesion disability and 7.49 points for people with physical disability, this implies that if the scope of housing renovation is made in the aspect of convenience, many obstacles in the house can be removed, and the satisfaction of the disabled with physical disability living in the house where such obstacles were removed can be increased.

B. Satisfaction Analysis by Space after Housing Renovation

The analysis of the satisfaction by space after the renovation of the housing is an important measure to determine to what extent the disabled can move around in a renovated housing.

the changes in the satisfaction level of the access route were the largest, it was found that the access route, which are for social participation and others but was not used due to obstacles, became available.

Table 8 shows the level of satisfaction with each residential space according to the type of disability in which the remodeling support was provided.

According to the analysis of satisfaction after remodeling by the type of disability, the change in satisfaction after residence was the highest level in the case of access route, and in the all groups with physical disabilities related to the movement in the access route, the satisfaction level was at a high level. In the case of the entrance, the average satisfaction score after residence was 6.85 points, but the score recorded 7.80 points and 7.39 points for people with brain lesion and physical disabilities, respectively. This means the use of facilities and the securing of accessibility through the removal of obstacles at the entrance have a great influence on the satisfaction of the house.

C. Satisfaction Analysis by Lifestyle after Housing Renovation

The satisfaction level after remodeling of each space according to lifestyles was the highest among the disabled who can walk alone, who showed the greatest change in satisfaction with the housing spaces such as access route and entrance.

For the disabled who can walk alone, a lot of renovations are being made in terms of environment, because there is no installation of convenience facilities or the range of facilities to be installed is small. Therefore, the reason for the change in satisfaction is that the extent of the renovation is within the range of understanding of people with disabilities.

In the second satisfaction survey after the remodeling, the disabled using clutches was found to be very satisfied with the access route after the renovation, showing the highest degree of satisfaction of 9.0 points. This can be seen as a result of the fact that the construction of the access route mainly includes the removal of the bottom step and the installation of the handle, so that it is possible for the disabled to move around the external space in their own residence without using clutches. Therefore, it is necessary to consider the installation of the handle at the same time as removing the step in the house where the disabled people reside, who use clutches.

V. CONCLUSION

This study carried out research of evaluation on 105 households of the disabled for whom the housing renovation was provided after they resided in the renovated house, and analyzed the satisfaction level by disability type, renovated space, and indoor lifestyle, so as to deduce the factors for establishing objective and reasonable range of remodeling of home for the disabled.

The results of this study are as follows.

First, in the satisfaction of the space before the housing reconstruction, the access route showed very low satisfaction among the people with all three types of disabilities such as brain lesion, physical, and intellectual

TABLE VIII: SATISFACTION ANALYSIS BY DISABILITY TYPE AFTER HOUSING RENOVATION

Classification	Disability Type	f	Satisfaction	
			①	②
Access Road	brain lesion disorder	8	9.13	8.00
	intellectual disorder	2	10.00	6.50
	physical disability	6	9.33	8.17
	sum	16	9.49	7.56
Entrance	epilepsy	1	10.00	7.00
	brain lesion disorder	15	9.00	7.80
	visual disorder	3	9.33	6.33
	kidney disorder	1	10.00	7.00
	autism	1	9.00	6.00
	multiple disabilities	7	9.14	7.29
	intellectual disorder	2	10.00	6.50
	physical disability	33	9.27	7.39
	auditory disorder	6	8.17	6.33
	sum	69	9.32	6.85

(①: Immediate Satisfaction after Renovation, ②: 4 month later Satisfaction after Renovation).

The space with the larger change in satisfaction surveyed was the access road than Entrance. As for the reason why

disabilities. Therefore, it is considered that the space which is most urgent for remodeling is the access route which is closely related to when the disabled go out of the house.

Second, the analysis of the satisfaction after the housing renovation showed that the disabled using clutches were most satisfied with the highest satisfaction score of 9.0 points in the second satisfaction survey after remodeling. This can be seen as a result of the fact that the construction of the access route mainly includes the removal of the bottom step and the installation of the handle, so that it is possible for the disabled to move around the external space within their own residence without using the clutch. Therefore, in the housing where the disabled using clutches reside, the removal of steps and the installation of a handle capable of supporting the disabled should be considered at the same time.

It is hoped that this study will be used as objective basic data in the implementation of the housing renovation project for the disabled supported by the government or the local governments on the basis of factors derived from this study to be considered in the remodeling of the living environment of the disabled. Further research could be conducted to derive factors for the renovation considering the cost aspect of the renovation so that more reasonable renovation can be possible.

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