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Comparative Review on Propriety of Estimating Rate for Defect Repairing Deposit through Apartment Building Scale

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ABSTRACT

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Keywords: 1. Introduction Modern society is increasingly interested in the efficient use and management of existing buildings rather than the demand for new buildings as the industry and economy are advanced and the culture come to full maturity [1]. This phenomenon is also applied to the residential space; and on the one side the construction of various houses is being done; at the same time; on the other side efforts to maintain existing houses are being made. [2]. In Korea; as a universalized form of housing; apartment building; especially apartments; is the main form of housing. These apartments are very popular in Korea because they are more advantageous than existing houses in terms of convenience of residence; maintenance cost; and safety. Therefore; many Koreans live in apartments or want to live in apartments [3]. However; Korean apartments are expensive among housing; and the disputes

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COMPARATIVE REVIEW ON PROPRIETY OF ESTIMATING RATE FOR DEFECT REPAIRING DEPOSIT THROUGH APARTMENT BUILDING SCALE

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Abstract

The defect repairing deposit is an important issue of the defect lawsuit in the apartment building, but it is a problem because there is no basic system in the establishment and operation of the legal system. We have proposed an estimating rate of defect repairing deposit through case analysis of defect lawsuit. However, the previous study had a limitation that the number of cases was relatively small and the characteristics of each case were not fully taken into consideration. In this study, therefore, we estimated defect repairing deposit rates according to the number of households and the total gross floor area, which are important factors of defect lawsuits. Through the variance analysis, it was confirmed that there is a difference between before and after 500 in the number of households and about 50,000 m^2 in the total gross floor area. The defects lawsuit collected based on this was divided into Group I and Group IV. As a result, it was confirmed that the larger the scale of group is, the lower the defect repairing deposit rate tends to be. Also, in case of the same scale, the rate of defect repairing deposit tends to increase in the additional case than the previous study.

Keywords:

1. Introduction

Modern society is increasingly interested in the efficient use and management of existing buildings rather than the demand for new buildings as the industry and economy are advanced and the culture come to full maturity [1].

This phenomenon is also applied to the residential space, and on the one side the construction of various houses is being done, at the same time, on the other side efforts to maintain existing houses are being made. [2].

In Korea, as a universalized form of housing, apartment building, especially apartments, is the main form of housing. These apartments are very popular in Korea because they are more advantageous than existing houses in terms of convenience of residence, maintenance cost, and safety. Therefore, many Koreans live in apartments or want to live in apartments [3].

However, Korean apartments are expensive among housing, and the disputes

surrounding them are accelerating due to the upgraded image by the subject of the business and the improvement of the divided owner's eye level.[4]

If the safety, function, and aesthetics required as housing are not properly demonstrated or significantly degraded, it becomes a dispute. This is called "defect" and the subject of defect varies widely throughout housing.

The lawsuit over defects occurring in apartments is becoming a social problem in Korea. In the case of defect lawsuits, the dispute between the parties about defects is fierce, and the purpose of the ultimate defect lawsuit is to estimate a reasonable defect repairing cost [3].

On the other hand, the judgment amount that can be called the conclusion of the defect lawsuit is defect repairing cost in terms of defect lawsuits. In defect lawsuits, the appraiser examines whether the defect repair is necessary or not, and what extent is appropriate. On the basis of this, the court judges the judgment amount to be added or

subtracted at the appropriate level. However, there are various influential factors in estimating the judgment amount of defect lawsuit, but the level of application for each factor varies depending on appraiser and court, and objective criteria to assist them are insufficient [3].

The defect repairing deposit among the most important legal issues in the defect lawsuit is one of the several things that are legally stipulated. The defect repairing deposit is originally prepared for the case where the subject of business or the contractor who built the apartment building cannot carry out the defect repair. The contractors participating in the apartment construction are obliged to deposit defect repairing cost with related financial institutions or obtain a guarantee [2].

However, the defect repairing deposit system in the current legal system is being exploited as an important measure of litigation by brokers who lead defect lawsuits. Defect lawsuit brokers propose defect repairing deposit as standard for damages promised to occupant while planning defect lawsuit. Therefore, many occupants have misunderstood that they can receive amount equivalent to defect repairing deposit as damages through defect lawsuit [2, 3].

In addition, the provisions of the Housing Act and the Apartment Building Management Act, which are representative laws for defect repairing deposits, are weak in various aspects. Each regulation stipulates superficial guarantee, and the basis system is insufficient. In particular, despite the nearly 40 years since its enactment, it still has not presented the argument regarding arbitrarily specified articles during the period of industrialization [2, 3].

The core agenda for defect repairing deposits can be divided into three categories: First, the estimating criteria of

the defect repairing deposit, second is the estimating rate, and the last is refund ratio when the warranty corresponding to each period is terminated when the warranty period expires, which is regarded as a main point [5].

Among these core issues, the estimating rate of defect repairing deposits is the most important issue. In the previous study, the case study on defect repairing deposit was conducted and new estimating rate of defect repairing deposit was proposed based on this analysis. However, there is a problem that the number of cases is small and the characteristics of each case are not considered sufficiently. It is also one of the things to consider as the limitation of the criteria based on the average.

In this study, we intend to find improvement measures that can be used as a basis for considering the impact on the estimating rate of defect repairing deposits. To do this, we intend to use the number of households and the total gross floor area that are known to be effective among the characteristics of each case.

2. Literature Review

2.1 Defect Repairing Deposit

2.1.1 Defect Repairing Deposit

The defect repairing deposit among the most important legal issues in the defect lawsuit is one of the several things that are legally stipulated. The defect repairing deposit is originally prepared for the case where the subject of business or the contractor who built the apartment building cannot carry out the defect repair. The contractors participating in the apartment construction are obliged to deposit defect repairing cost with related financial institutions or obtain a guarantee [2].

2.1.2 History of Defect Repairing Deposit System

The defect repairing deposit system is related to the Housing Construction Promotion Act (1972), which was enacted

to promote housing construction in industrialized society. In addition, the defect repairing deposit was first institutionalized as Decree on the Management of Apartment Houses(1979) was enacted. Estimation criteria for defect repairing deposits can be found in the Regulations on the Management of Apartment Buildings. According to the Regulations, the defect repairing deposit is to pay a cash or guarantee that is more than two-hundredth of the total project cost described in the business plan, and the keeping period is set to two years.

The revision of Decree on the Management of Apartment Houses(1981) regulated the subject of business's term of warranty liability, and defect repairing deposits and implementation procedures. As a result, the defect repairing deposit obliges the financial institution to deposit a cash or guarantee equivalent to three-hundredth of the total construction cost of the apartment building, excluding land and land prices.

Since then, the laws and ordinances has been revised and the related regulations have been changed to the Housing Act (2003) and the Apartment Building Management Act (2016). However, the estimating criteria and the rate of defect repairing deposit remain unchanged.

2.2 Problems of Defect Repairing Deposit

2.2.1 Review of related system history

The regulations on defect repairing deposits that were set arbitrarily during the industrialization era have no basis for establishing standards. Korean society in the 1970s and 1980s lacked many social bases including physical infrastructure as well as cultural aspects, and it was turbulent period of change. In addition to defect repairing deposits, many social systems are insufficient.

However, since the 1990s, the social climate has begun to change as the economy and politics become stable. Unlike before, discussions on the social agenda have

begun to be systematically made. Even the small provisions of the legal system are found, analyzed, and adjusted to the reality through numerous dialogues and discussions [6].

On the other hand, there is a lack of such efforts for the provisions on defect repairing deposits, and there is no basis for establishing the system yet. No one knows why criteria for calculating the total amount of defect repairing deposits is the total cost of the construction, and why the ratio is 3% [6].

In previous research, defect repairing cost, which is most closely related to establish the basis for defect repairing deposit, was examined. The defect repairing deposit is for the case where the subject of business responsible for defect repair is not able to repair the defect. In case the subject of business becomes bankrupt or in the condition impossible to carry out defect repair, it is stipulated by the law that the occupants withdraw defect repairing deposit and make the defect repair. The defect repairing deposit is limited in use, but it is set to be used for defect repair. Therefore, estimating defect repairing deposit needs to be linked with defect repairing cost [6].

Nonetheless, current laws and ordinances are based on total construction costs that are not directly related to defect repairing costs. It is worth considering that in 1979 or 1981 when these standards were enacted, there were not many apartment buildings and there was little actual results data on defect repairing costs.

However, since the 1990s, when the construction of apartment buildings became commonplace and accumulated a lot of data, in particular, when the housing law was enacted in 2003, reasonable and objective standards should have been prepared. However, even in the Apartment Building Management Law, which recently

enacted separate laws on apartment buildings, there has been no such effort [6].

2.2.2 Misuse in defect lawsuits

Another reason why defect repairing deposits are important is that they are being misused as an important measure of litigation by brokers who are responsible for defect lawsuits.

Defect lawsuit brokers propose defect repairing deposit as standard for damages promised to occupant while planning defect lawsuit. Therefore, many occupants have misunderstood that they can receive amount equivalent to defect repairing deposit as damages through defect lawsuit [7].

2.2.3 Criteria for estimating defect repairing deposit

The estimating standard for the defect repairing deposit is the total construction cost. However, this is suitable as an estimating standard for the performance bond according to the construction stage, but it is unreasonable as an estimating standard of defect repairing deposit. The defect repairing deposit is for the case that the subject of business or contractor who is liable to repair the fault will not be able to repair the defect. Therefore, it is more reasonable to estimate the actual repair cost to be paid for defect repair. Also, in the case of defect lawsuits, the damages paid as a result of the trial are the defect repairing costs legally stipulated.

2.2.4 Defect Repairing Deposit Estimating Rate

Reviewing the related system history, there is no ground that the estimating rate of the defect repairing deposit is set at 3% of the total construction cost. In recent years, the purpose and reason of system are explained when establishing or changing a system. However, the provisions for defect repairing deposits were established and operated about 40 years ago. At that time, the social systems as a whole were established and operated without clear

ground system. Therefore, it is difficult to evaluate rationality based on current standards.

2.2.4.1 Review of suitability through case analysis and proposal of rate

Therefore, in order to compensate for this, we examined the extent of the appropriate level through the case analysis of defect lawsuit. The previous study on the estimation rate of defect repairing deposit shows that the average rate of defect repairing deposit through analysis of 48 cases was 1.11%. This was less than half compared with 3% of the total construction cost stipulated in the relevant laws and regulations. Through this, we have proposed 1.5% as estimating rate of defect repairing deposit. [6].

2.2.4.2 Expert Survey on the Proposal

In order to examine the appropriateness of the above-mentioned defect repairing deposit estimating rate, the questionnaire was also conducted on related experts [2].

As a result of the survey on lawyers, architects and professional appraisers related to defect lawsuits, they answered the estimating rate of defect repairing deposits was inadequate (69.1%). On the other hand, the newly proposed estimating rate was appropriate (72.7%).

2.2.4.3 Comparison Verification of Proposal Rate Additional Case

On the other hand, a study was conducted to supplement the limitation that the number of case studies for existing performance studies is small and analyzed only on the basis of average [7].

In this study, the rate of defect repairing deposit of defect lawsuits was estimated for 239 cases, and the distribution state by each interval was examined by setting the interval by each rate. As a result, the estimating rate of defect repairing cost is 1.14%, which is not much different from the previous one.

2.2.5 Annual Refund Ratio of Defect Repairing Deposit

2.2.5.1 Review of the annual refund ratio

The defect repairing deposit is required to refund the deposit at the end of each warranty period in accordance with relevant laws such as the Housing Act (Table 1).

However, like the other agendas related to defect repairing deposits, there is no basis for the establishment of regulations on annual refund ratio.

Table 1. Annual Refund Ratio of Defect Repairing Deposit

Year	Refund Ratio
1	10%
2	25%
3	20%
4	15%
5	15%
10	15%
Sum	100%

2.2.5.2 Suitability Review through case analysis and Proposed Rate [5]

Therefore, previous studies analyzed the defect repairing costs of defect lawsuits and summarized the results by construction type and year. As a result, it was found that defect repairing cost actually needed more than the prescribed rate in case of 1 ~ 2 years and 5 ~ 10 years. On the other hand, in the case of 3 ~ 4 years, the defect repairing cost actually required was very small.

Based on this analysis, we proposed to modify the annual refund ratio of the defect repairing deposit as follows (Table 2).

Table 2. Suggestion on Annual Refund Ratio of Defect Repairing Deposit

Year	Refund Ratio
1	15%
2	35%
3~4	10%
5~10	40%
Sum	100%

2.3 Raised Problems

2.3.1 Limitations of the previous study

The previous study examined the interrelationships among factors such as number of households, total gross floor area, deposit, appraisal, and judgment amount of defects lawsuit cases [3].

However, there was no research on how these factors affect the setting of the estimating rate of defect repairing deposits to an appropriate level.

In addition, we proposed a estimating model of defect repairing deposit through defect lawsuit case analysis [3]. However, the characteristics such as number of households and total gross floor area of each case were not considered sufficiently. Therefore, it is imperative to prepare measures to overcome the limitations of previous researches, such as the fact that the regression model presented has a large variation in accuracy for each case.

In sum, previous studies conducted a case study on defect repairing deposit to derive the factors affecting defect repairing deposit and to estimate the defect repairing cost and newly proposed the estimating rate of the defect repairing deposit.

However, there are many problems to be solved in the future such as the relatively small number of cases studied, insufficient consideration about characteristics of each case, the limitations of an average-based criterion, etc.

2.3.2 Necessity of Research

In this study, we intend to find an improvement measure that can be a more accurate and realistic criterion for estimating rate of defect repairing deposit. To do this, we will use the number of households and the total gross floor area that are known to be effective among the characteristics of each case.

In this study, we collected more cases by supplementing the previous study and divided into groups according to the number of households and the total gross floor area. We also will propose estimating rate of defect repairing deposit according to statistical analysis results analyzed by each group. Also, we will propose 95% of confidence interval of each mean value considering the limit on the utilization of the mean value.

3. Research Methods

3.1 Case Data

In this study, we intended to compare the data collected from the previous study with those collected further. The cases of previous study are 48 apartment complexes and the cases of additional data are 240

3.2 Analysis Method

We examined what effect the number of households and the total gross floor area have on the rate of defect repairing deposit. For this purpose, variance analysis and correlation analysis were performed.

After that, we obtained the representative value of the rate of defect repairing deposit and calculated 95% of the confidence level of it. In this study, the average was set as the representative value.

3.3 Analysis Sequence

The detailed procedure of the study is as follows. First, analyze the correlation between the number of households, the total gross floor area and the rate of defect repairing deposit for each case of the previous study. Second, if this analysis is significant, perform regression analysis. On the other hand, if there is no direct correlation, divide each case into a number of households and a total gross floor area by scale and review the difference between groups. One-way ANOVA or independent sample T-tests are performed according to the number of groups. Third, when the difference between case groups is

confirmed, obtain representative value of defect repairing deposit rate for each separated group. Fourth, analyze the additionally collected data in the same way. Fifth, compare the case group of the previous study with the additional collected case group.

4. Analysis & Results

4.1 Review of Number of Households and Total Gross Floor Area

The results of previous study confirmed that there was a correlation between the number of households, the total gross floor area, the defect repairing deposit, and judgment amount (the defect repair cost).

On the other hand, the correlation analysis of the number of households and defect repairing deposit did not derive significant results. The same was true for the total gross floor area.

Therefore, this study divided the groups by the number of households and total gross floor area, and compared their variances.

4.1.1 Number of households

The defect repairing deposit rate according to the number of households is shown in the following figure (Figure 1). In order to determine the number of effective households, we divided the groups into the following order and analyzed.

First, we divided the scale of the number of households into 500 households, 500 ~ 1,000 households, 1,000 ~ 1,500 households, and 1,500 ~ 2,000 households, and as a result of group differences, there was no difference between groups by one-way ANOVA. Next, we divided the number of households into less than 1,000 households and more than 1,000 households. There was no difference in the results of examining the difference between these groups by the independent sample t-test. However, there was the difference

when dividing by 500 households, (Table 3).

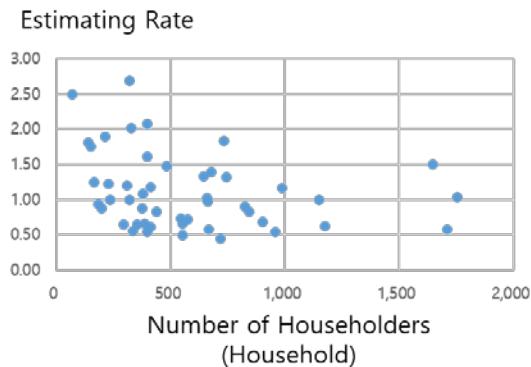


Figure 1. Estimating Rate for Defect Repairing Deposit by Number of Households

Table 3. Classification of Group by Number of Households

Case	Classification of Group	Variance	Validity
1	less than 500 500~1,000 1,000~1,500 1,500~2,000	One-way ANOVA	No
2	less than 1,000 more than 1,000	t-test	No
3	less than 500 more than 500	t-test	Yes

4.1.2 Total gross floor area scale

The total gross floor area was also analyzed after the number of households. The rate of defect repairing deposit according to the total gross floor area is shown in the following figure (Figure 2). In order to determine the effective total gross floor area scale, the following groups were divided into the following order.

First, the total gross floor area was divided into 50,000 to 100,000 m², 100,000 to 50,000 m², and 150,000 to 200,000 m². And group differences were examined. As a result, there was no difference between groups. Second, the total gross floor area was divided into 100,000 m² and over 100,000 m², but there was no difference. Finally, when divided by 50,000m², there

was a difference in the rate of defect repairing deposit (Table 4).

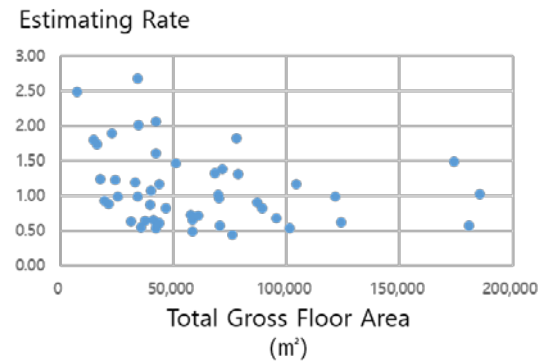


Figure 2. Estimating Rate for Defect Repairing Deposit by Total Gross Floor Area

Table 4. Classification of Group by Total Gross Floor Area

Case	Classification of Group	Variance	Validity
1	less than 50,000 m ² 50,000~100,000 m ² 100,000~150,000 m ² 150,000~200,000 m ²	One-way ANOVA	No
2	less than 100,000 m ² more than 100,000 m ²	t-test	No
3	less than 50,000 m ² more than 50,000 m ²	t-test	Yes

4.1.3 Analysis Group Settings

To put the above together, in order to analyze the rates of defect repairing deposits for defect lawsuits, classification standards by size of the number of households and the total gross floor area are 500 households and 50,000 m². In sum, it can be divided into the following four groups (Figure 3).

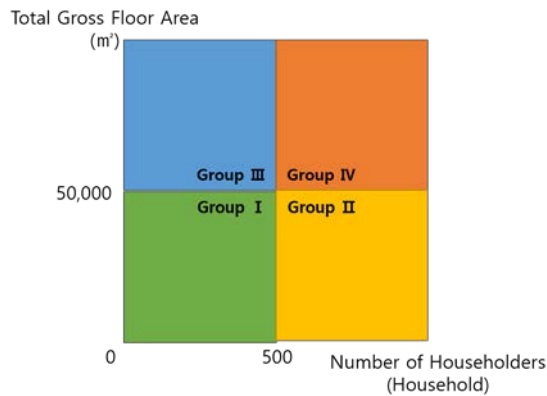


Figure 3. Classification of Case Group

4.1.4 Groups of previous study

The results of classifying the previous study by the above group are shown in the following figure (Figure 4). In the case of group I and group IV, minimum data for analysis were obtained, but group II and group III are not easy to analyze because there are few cases.

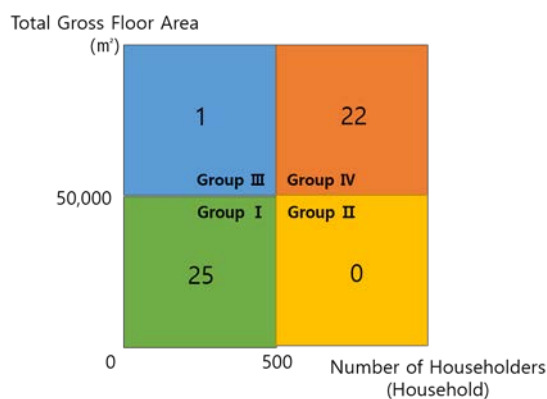


Figure 4. Case Group of Literature Study

4.1.5 Groups of Additional Cases

On the other hand, additional cases were classified as follows (Figure 5). Among the 240 cases, Group I consisted of 53 cases, Group II was 2 cases, Group III was 38 cases, and Group IV was 147 cases. As the previous study, the number of data for analysis is too small for Group II. On the other hand, in the case of Group III, 38 cases can be analyzed for additional cases, but the number of previous study is so small, so it is difficult to compare.

This study premises the comparison between the previous study and the additional case. Therefore, in the subsequent analysis, it proceeds only for group I and group IV.

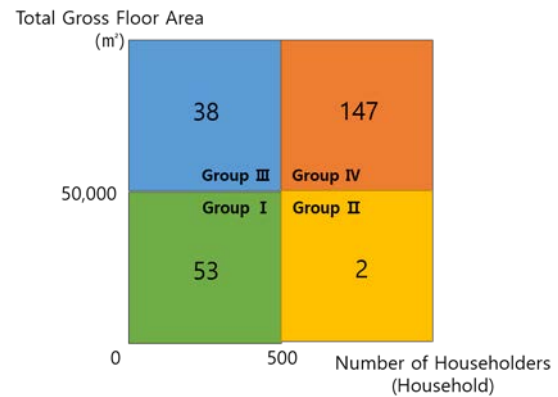


Figure 5. Case Group of Additional Data

4.2 Comparison by Group

4.2.1 Group I

Estimating rate of defect repairing deposit of previous study in group I is 1.26% on average. The 95% of confidence interval for the mean is 1.006 to 1.506.

On the other hand, the estimating rate of the defect repairing deposit for the additional case is 1.46% on average. The 95% of confidence interval for the mean shows 1.175 to 1.735.

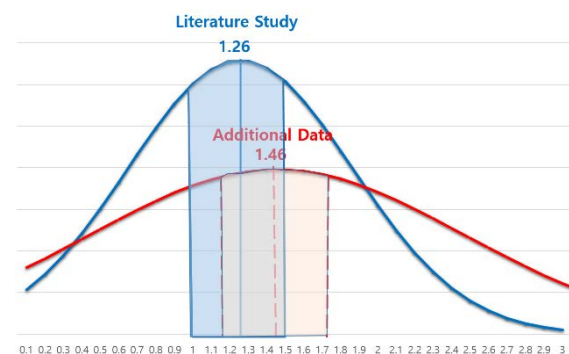


Figure 6. Comparison of Group I

4.2.2 Group IV

The estimating rate of the defect repairing deposit in the previous study in Group IV is 0.92% on average. The 95% of confidence interval for the mean is 0.763 to 1.085.

On the other hand, the estimated rate of defect repairing deposits for additional cases is 0.97% on average. The 95% of confidence interval for the mean shows 0.862 to 1.073.

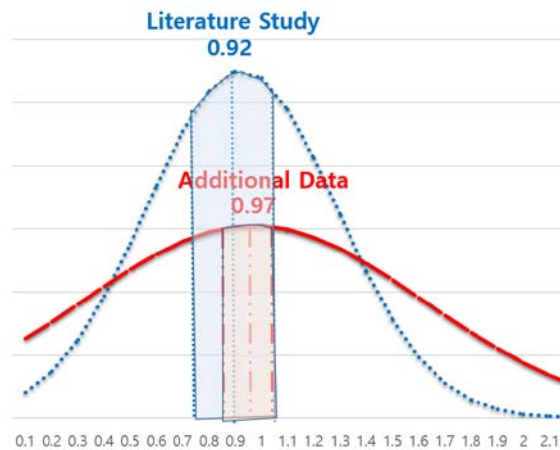


Figure 6. Comparison of Group IV

4.3 Results

According to the above-mentioned analysis results, in case of Group I with a number of households less than 500 and a total gross floor area less than 50,000 m², the average rate of defect repairing deposit of previous study was 1.26% while the additional case was 1.46%, which was 0.2% higher.

On the other hand, in the case of group IV with a total number of households of 500 or more and a total gross floor area of 50,000 m² or more, the previous study was 0.92% and the additional case was 0.97%, which was only 0.05% higher.

In sum, the rate of defect repairing deposit of the additional cases was higher than that of the previous study. In addition, the relatively small group I showed higher defect repairing deposit rates than the larger group IV. However, this means that the ratio is high and does not mean that real defect repairing cost is higher.

5. Discussion & Conclusion

As a result of analyzing the effect of number of households and total gross floor area on the estimating rate of defect repairing

deposit, it is found that there is a difference of tendency if divided into groups of appropriate scale. 500 households of the number of households, and 50,000 m² of the total gross floor area were the standards. When divided into four groups By these standards, the groups that can be compared to collected case data are group I and group IV.

As a result of the case study, in the previous study, group I was 1.26% and group IV was 0.92%. In additional cases, group I was 1.46% and group IV was 0.97%. In both groups, group IV was lower than group I. As a result, it can be confirmed that the larger the group, the lower the defect repairing deposit rate tends to be. In addition, this trend was more conspicuous in the additional case than in the previous study.

On the other hand, for Group I, the previous study was 1.26% and the additional case was 1.46%, and the defect repairing deposit rate for the additional case was higher. In the case of group IV, the previous study was 0.92% and the additional case was 0.97%. In both sides, additional cases were higher than previous studies. In other words, in the case of the same scale, the rate of defect repairing deposit tends to increase in the additional case than in the previous study. However, due to the difference in trends, Group I increased by 15.9% and Group IV increased only by 5.4%.

In this study, we proposed to estimate the defect repairing deposit by the appropriate scale according to the number of households and the total gross floor area. In the future, through data collection and analysis of other factors, we would like to contribute to establishing estimating system of more accurate and realistic defect repairing deposit.

6. Acknowledgment

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7. References

[1] Park, J., Kim, O., Kim, J. (2011), Revitalization of the Conciliation System for Defect Disputes Related to Apartment Buildings, *Journal of Korea Institute of Building Construction* (11, 3): pp.208-220.

[2] Park, J., Seo, D. (2016), Suggestion on Estimating Rate for Defect Repairing Deposit in Apartment Building through Survey with Experts, *Proceeding of International Association of Civil, Agricultural and Environmental Engineering Researchers*

[3] Park, J., Seo, D. (2016), Basic Study on Influence Factors for Defect Repairing Cost of Apartment Building in Korea, *Proceeding of 2016 International Conference on Applied Mathematics and Mechanics*

[4] Park, J., Seo, D. (2014), Development of Standard Work Process Model for Defect Consulting on Korea Apartment Housing, *International Journal of Applied Engineering Research* (9, 23): pp.18167-18174.

[5] Seo, D., Park, J. (2017), Suggestion on Annual Refund Ratio of Defect Repairing Deposit in Apartment Building through Defect Lawsuit Case Study, *Proceeding of International Conference on Studies in Architecture, Civil, Construction and Environmental Engineering*: pp.64-68.

[6] Park, J., Seo, D. (2016), Suggestion on Estimating Rate for Defect Repairing Deposit through Case Study of Defect Lawsuit in Korean Apartment Building, *Proceeding of International Association of Civil, Agricultural and Environmental Engineering Researchers*

[7] Seo, D., Park, J. (2017), Comparative

Study on Estimating Rate for Defect Repairing Deposit of Defect Lawsuit in Apartment Building, *Proceeding of International Journal of Structural and Civil Engineering Research*