

An analysis of the utilization of defect deposits for apartment complexes

Seo, Deok-Seok¹ Lee, Ung-Kyun^{2*}

Division of Architecture, Halla University, Wonju-Si, Gangwon-Do, 210-712, Korea¹

Division of Architecture, Kwandong University, Gangneung-Si, Gangwon-Do, 210-701, Korea²

Abstract

This study analyzed the actual use of defect deposits for financing long-term expenses (that is, expenses incurred within 4 - 10 years of building completion) and for financing short-term expenses (that is, expenses incurred within 3 years of building completion). Therefore, 36 cost data on the expenses financed out of defect deposits for apartment complexes were collected from construction companies and analyzed using statistical methods. The findings revealed that 62.6 percent of defect deposits were spent to resolve actual defects, and 37.4 percent were spent resolving resident complaints. Furthermore, these results are valid regardless of the location of the complexes. As such, these results could be of significance when establishing or revising regulations regarding the repair of the long-term defects of apartment complexes.

Keywords : defect, defect deposit, expense on residents' complaints

1. Introduction

1.1 Research background and objective

A building construction project requires a relatively long duration of about 2 to 3 years to finish due to its composite characteristics, which involve a combination of diverse processes[1]. The composite processes are known as one of the main causes of diverse quality issues, and to resolve this problem, a wide range of studies has been conducted, including an analysis of the current state of defect occurrence and the development of management systems[2], an analysis of residents' dissatisfaction according to defect type[3], a presentation of a checklist of major work types

through measuring the importance of defects by work type[4], a presentation of the defect handling process through an analysis of residents' satisfaction[5], a presentation of a plan to improve the defect handling process through an analysis of the advance checklist for residents[6], a study on improving the efficiency of defect classification[7], and the development of a plan for IT-based quality control implementation[8].

Studies related with defects of apartment buildings can be classified into analyses of the defect types found in apartment buildings, proposals to improve construction, and plans to increase the efficiency of defect classification and systemization of management, while the studies related to the use of deposit for defect repair, an actual interest of residents and construction companies, include an analysis of defect cost incurred in the apartment building by Shin et al.[9], and an analysis of defect deposits at the third year by Seo et al[1]. Shin[9] analyzed the data from only one company,

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* Corresponding author: Lee, Ung-Kyun

[Tel: 82-33-649-7548, E-mail: uklee@kd.ac.kr]

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focusing on the measurable items that might be more advantageous to defect management, but the question of whether the costs input for defect repair were actually used to repair defects or for other purposes due to unreasonable demands by residents was not clearly addressed. Seo et al.[1] divided defect deposits of apartment defect repair into costs for complaints and cost for defects, but a limitation to this study was that it did not deal with all the defects found for the entire defect liability period of 10 years, but studied only those found in an early stage of the liability period, 1 to 3 years after residents moved in.

In this study, defect deposits data from the top 5 apartment construction companies on defect repairs done in the 4th to 10th year of the liability period were analyzed by dividing them into repairs made to address complaints and repairs made to address defects, and then the results were compared with the data from the early stage (within 3 years) to determine the differences between them. To accomplish this, the current state of defect deposits of long-term defect repair for apartments in Korea was identified to provide fundamental data construction companies can use in the future to derive strategies.

1.2 Research methodology and scope

This study aims to analyze the historical data of defect repairs actually reported in apartment complex buildings, where 10th-year defect repairs were finished, and to analyze problems of current defect repair work by dividing the costs into defect repair and complaint repair.

To do this, using the historical defect repair costs data of 36 apartment complexes provided by a total of 5 construction companies in which the 10th year of defect repair had already been complete, we analyzed the current state of defect re-

pair costs actually spent repairing defects. We defined up to the 3rd year of defect repair costs analyzed by Seo et al.[1] as the defect deposits for short-term defect repairs, while the 4th to 10th year of defect repair costs analyzed in this study were defined as the defect deposits for long-term defect repairs.

2. Summary of historical data of deposit of defect repair

2.1 Definition of the deposit for defect repair system

The deposit for defect repair system was enacted on December 12, 1979 as Rule No. 257 on the Management of Apartment Houses, which is a kind of liability for the defect repair in which a certain amount of money required for defect repair (2% to 3% of the entire construction cost) is publicly managed to impose the legal responsibility for defect repair on the construction companies when any defect is found after the completion of the building's construction[1].

The deposit for defect repair system was established on December 12, 1979 as Rule No. 257 on the Management of Apartment Houses, and the deposit was set as 2% of the entire construction cost. Since then, the deposit level was increased to 3% under Decree No. 14352 on the Management of Apartment Houses on August 3, 1994[1].

2.2 Summary of historical data of deposit of defect repair for apartment buildings

The historical data of defect deposits of the 4th to 10th-year defect repair of 36 apartment complexes from four member companies of the Korea Housing Association were analyzed. The historical data of the 4th- to 10th-year defect repair includes 7 cases of Company A, 10 cases of Company B, 6 cases of Company C, 5 cases of Company D, and 8

cases of Company E, for a total of 36 cases. Each case refers to one apartment complex, and the analysis was performed on total defect repair costs actually input in 4 to 10 years after the completion of apartment building projects. The costs are divided into costs related to actual defect repairs and costs related to residents' complaints, and an adjustment was made for the composite data in accordance with the ratio of each data to the entire set of data.

The complexes averaged 708 households each, with the range being from 111 households to 2,322 households. By region, 8 complexes were in Seoul, 4 were in the metropolitan area, 4 were in Yeongnam, 7 were in Chungcheng, 9 were in Honam, 2 were in Gangwon, 1 was in Busan, and 1 was in Incheon.

Table 1. Descriptive statistics of the cases

Items	Mean	Maximum value	Minimum value
Number of houses	708	2,322	111
Total area(m ²)	89,740	544,781	5,491
Number of buildings	10	25	2

3. Analysis of historical data of deposit of defect repair

3.1 Definition of related terms

In this study of the costs actually input for defect repair, the costs accounting for 4th-to-10th-year defect repair were defined as defect deposits. Before reviewing defect deposits, we divided defect deposits into costs for actual repair and costs related to resident complaints to get clearer analytical results. Actual repair costs refer to the costs actually put into defect repair, while repair costs related to resident complaints refer to the costs spent beautifying the complex at the request of residents, including the installation of a parking system, CCTV, au-

to-door open at the front gate of apartment buildings, exterior wall painting, landscape tree planting, and landscape stone placement[1].

3.2 Analysis of descriptive statistics

3.2.1 Defect deposits by complex

Average closing cost of defect repair for 4th-to-10th-year of complex stands at KRW 240,146,618, of which the actual repair cost was KRW 150,392,696 or about 62.6%, and the repair cost related to resident complaints was KRW 89,752,922, or about 37.4%.

Unlike the result of a previous study for the 3rd-year repair closing cost, which found that the input rate of actual repair cost was similar with that of the repair cost related to resident complaints, the actual repair cost was shown to be about 25% higher in the defect deposits for 4th-to-10th-year repair from the analysis of this study. This might be because the cost input for actual repair increases more rapidly compared to cost input for repair due to resident complaints.

3.2.2 Defect deposits by household/unit area

In terms of defect deposits by complex analyzed earlier, the defect deposits can vary depending on the size of a complex, and were analyzed by household and by unit gross area for a more accurate analysis of defect deposits(see Table 2).

In terms of 4th-to-10th-year repairs, the closing cost of defect repair by household was analyzed to be 424,578(won/household). Of the closing cost, the actual repair cost was 259,294(won/household) or 61.1%, while the repair cost related to resident complaints was 165,284(won/household).

The closing cost for defect repair by unit area was 4,306(won/m²), which consisted of 2,314(won/m²) or 53.7% for actual repair costs and 1,992(won/

m²) or 46.3% for repair costs related to resident complaints. Compared with defect deposits by household, the ratio of actual repair costs to repair costs related to resident complaints decreased, which means that the defect deposits for a larger size of an apartment are relatively low. This is believed to be one of the reasons why large construction companies have been increasing their investment in larger-scale apartment complexes.

Table 2. Detailed information of the cases

Case ID	Number of houses	Total area	Number of buildings	Location of the complex
A-10-01	1,500	186,148	10	Yeongnam
A-10-02	600	72,913	17	Honam
A-10-03	747	65,442	9	Gangwon
A-10-04	309	43,767	6	Metropolitan area
A-10-05	440	74,914	5	Chungcheong
A-10-06	218	26,925	1	Yeongnam
A-10-07	1,392	222,934	12	Chungcheong
B-10-01	397	15,632	4	Honam
B-10-02	539	16,150	5	Honam
B-10-03	479	16,663	5	Honam
B-10-04	520	12,454	6	Chungcheong
B-10-05	211	6,984	1	Busan
B-10-06	720	39,157	12	Seoul
B-10-07	417	14,025	3	Incheon
B-10-08	270	11,860	3	Seoul
B-10-09	172	13,896	3	Seoul
B-10-10	1,153	44,680	16	Honam
C-10-01	272	23,000	5	Metropolitan area
C-10-03	552	78,240	8	Chungcheong
C-10-04	937	97,175	11	Chungcheong
C-10-06	456	50,425	5	Honam
C-10-07	448	65,208	6	Honam
C-10-10	182	28,019	3	Seoul
D-10-01	208	32,655	2	Honam
D-10-02	323	42,289	5	Chungcheong
D-10-03	466	46,337	6	Chungcheong
D-10-04	673	120,744	10	Gangwon
D-10-05	870	105,127	9	Honam
E-10-01	1,050	110,741	14	Yeongnam
E-10-02	748	77,891	32	Yeongnam
E-10-03	1,114	177,827	10	Seoul
E-10-04	375	13,647	4	Seoul
E-10-05	217	36,812	2	Seoul
E-10-08	282	37,732	3	Metropolitan area
E-10-09	388	50,972	5	Seoul
E-10-10	421	49,213	6	Metropolitan area

This was identified using multiple linear regression analysis. The closing cost of defect repair was set as a dependent variable, while the number of households, gross area and the number of apartment buildings were set as independent variables to perform a regression analysis. In the regression analysis, the number of households and the number of apartment buildings were eliminated as insignificant variables, and only gross area was verified as a significant variable. Based on this, gross area is believed to be a significant factor that has an impact on defect repair cost, and this should be considered in the future in order to improve the related system.

3.2.3 Closing cost analysis of defect repair per household by company

In order to analyze the defect deposits by company, we examined the 4th-to-10th-year repair cost data from each company. In terms of the closing cost of defect repair by household, Company A was analyzed to be highest. As shown in Figure 1, the cost spent by each company was as follows: 821,593(won/household) by Company A, 145,147(won/household) by Company B, 206,083(won/household) by Company C, 93,692(won/household) Company D, and 797,153(won/household) by Company E.

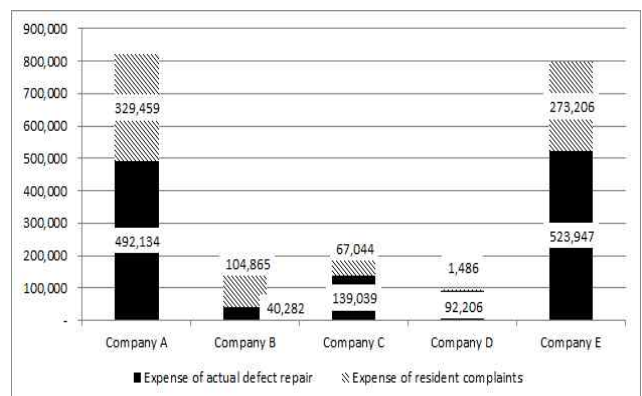


Figure 1. Defect deposits per unit house

In addition, the 3rd year defect deposits by company were analyzed. Dividing the defect deposits into the actual repair cost and repair cost related to resident complaints, for Company A, the ratio between the actual repair cost and the repair cost related to resident complaints stood at 6:4, or KRW492,134 to KRW329,459. As for Company B, the actual repair cost per household was KRW40,282 while the repair cost related to resident complaints per household was KRW104,865, indicating that the proportion of repair cost related to resident complaints was shown to be significantly higher. For Company C, the actual repair cost was KRW139,039 while the repair cost related to resident complaints was KRW67,044. For Companies D and E, the actual repair cost was KRW92,206 and KRW 523,947, respectively, while the repair cost related to resident complaints was KRW1,486 and KRW273,206, respectively. These differences arose out of each company's different expertise in defect repair, which means the differences are believed to lie in each company's different ability to handle different defects.

3.2.4 Analysis of defect deposits per unit area by company

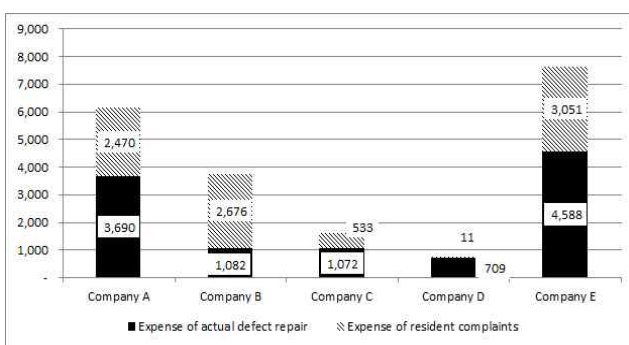


Figure 2. Defect deposits per unit area

Through the analysis of the defect repair costs per unit area by company, it was found that

Company A spent KRW6,160 per unit area, Company B KRW3,757, Company C KRW1,605, Company D KRW720 and Company E KRW7,639. The repair costs spent by Companies A and E were up to 9 to 10 times those spent by Company D, which can be interpreted as not being related to regional differences but to the different criteria for expenses of each company.

In addition, when analyzed by dividing the defect repair costs of each company into the actual repair cost and the repair costs related to resident complaints, the actual repair cost was shown to be KRW3,690 for Company A, KRW1,082 for Company B, KRW1,072 for Company C, KRW709 for Company D, and KRW4,588 for Company E, averaging KRW2,228 per unit area.

The repair cost related to resident complaints was shown to be KRW2,470 for Company A, KRW2,676 for Company B, KRW533 for Company C, KRW11 for Company D, and KRW3,051 for Company E, averaging KRW1,748 per unit area.

In terms of the ratio of defect deposits by household, it stood at 60:40 for Company A, 28%:72% for Company B, 67%:33% for Company C, 98%:2% for Company D, and 66%:34% for Company E. Through the analysis, it was found that the defect deposit by unit area was not significantly different from the defect deposit by household. Companies A and E accounted for 84% of the defect deposits analyzed in this study, which might cause data distortion. For this reason, the detailed analysis by company is believed to be more meaningful than the analysis of the entire set of data. As mentioned previously, each company's ability to handle defects itself is believed not only to determine repair costs (both the actual defect repair cost and the repair cost related to resident complaints) but also to determine the fund size required for the repair costs.

Table 3. Ratio of each defect deposit

Companies	Defect deposits per unit house		Defect deposits per unit area	
	For actual defect repair	By resident complaints	For actual defect repair	By resident complaints
A	60%	40%	60%	40%
B	28%	72%	29%	71%
C	67%	33%	67%	33%
D	98%	2%	98%	2%
E	66%	34%	60%	40%

4. Analysis of defect deposits by region

4.1 Summary

In this section, defect deposits were analyzed by region. In different regions, residents may have different expectations due to regional characteristics. As in the previous sections, we analyzed defect deposits by region by dividing them into the actual repair cost and the repair cost related to resident complaints.

As mentioned earlier, the apartment complexes included 8 complexes in Seoul, 4 in the metropolitan area, 4 in Yeongnam region, 7 in Chungcheong region, 9 in Gangwon, 1 in Busan, and 1 in Incheon. We divided the geographic area covered into three regions in consideration of the difference in the samples collected: the metropolitan area including Seoul, the Chungcheong and Honam region, and the other region. As the result, the samples were grouped into 12 complexes in the metropolitan area, 16 complexes in the Chungcheong and Honam region, and 8 complexes in the other region.

The complexes were grouped in consideration of similarity in regions, and Seoul and the metropolitan region were combined into one, Chungcheong and Honam into another, while Busan and Incheon were combined with Yeongnam and Gangwon into the other region due to an insufficient number of samples.

4.2 Analysis of defect deposits by complex

By region, the defect deposits for 4th-to-10th-year defect repair amounted to KRW1,532,145,865 in the metropolitan area, of which 61.9% was for the actual repair cost and 38.1% was for the repair cost related to resident complaints. The defect deposits for 4th-to-10th-year defect repair amounted to KRW1,659,850,526 in Chungcheong and Honam region, of which 61.4% was for actual repair costs while 38.6% was for repair costs related to resident complaints. There were no significant differences found between the metropolitan area and the Chungcheong and Honam region. However, the defect deposits for 4th-to-10th-year defect repair amounted to KRW1,130,642,736, of which 65.3% was for actual repair costs and 34.7% was for repair costs related to resident complaints. To identify the reasons for the different results in the two regions, the raw data was analyzed, and it was found that the complexes in Incheon and Busan showed a much higher repair cost related to resident complaints, which might cause this difference. Other complexes in the other region showed a similar ratio and analytical results to the two regions analyzed earlier. When these outliers are excluded, there was no peculiarity found depending on complex or region. From this, it may be interpreted that the construction companies that collect data build apartment complexes across Korea and follow standard managerial guidelines.

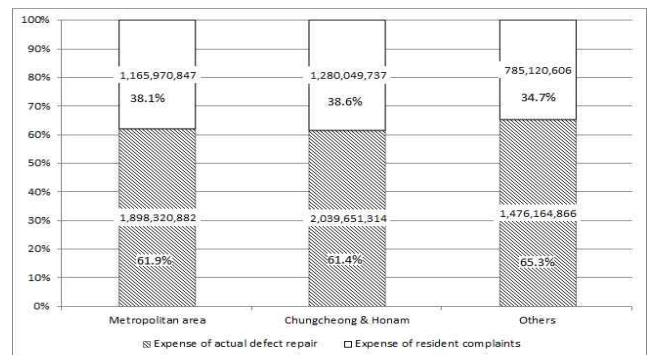


Figure 3. Defect deposits of each area

4.3 Analysis of defect deposits per household/unit area by region

The defect deposit per household/unit area by region was shown to be 648,939 (won/household) in the metropolitan area, followed by 339,438 (won/household) in the Chungcheong and Honam region, and 406,414 (won/household) in the other region. The ratio of defect deposits by region, similar to the earlier analyses, was shown to be 61.9% for actual repair costs to 38.9% for repair costs related to resident complaints in the metropolitan area, 61.4%:38.6% in the Chungcheong and Honam region, and 65.3%:34.7% in the other region.

Through the analysis, it was found that defect deposit per household was higher in the metropolitan area than in both other regions, which implies that the material cost and labor cost and maintenance cost which incur the overall expenses are higher in the metropolitan area.

By region, the defect deposit per unit area was shown to be KRW5,827 in the metropolitan area, followed by KRW3,340 in the Chungnam and Honam region and KRW3,714 in the other region.

Per unit area, the ratio of defect deposit spent on repairs to defect deposit spent on resident complaints was shown to be the same as per household, 61.1% for actual repair cost to 38.9% for repair costs related to resident complaints. In the analyses of defect deposits by household and company above, the repair cost related to resident complaints in the defect deposits per unit area was 46.3%, a higher share than in the defect deposit per household. However, the analytical result by region was different.

The complexes which bear higher repair costs related to resident complaints are distributed evenly by region and there is no outstanding impact on a specific region, and for this reason the result was different from the aforementioned ana-

lytical results. In addition, like the analytical results per household by region, the defect deposit was shown to be higher in the metropolitan area than in any other region, which seems to be affected by the specific cause aforementioned.

5. Comparison of the long-term defect deposits with the short-term defect deposits

To identify the differences between short-term defect deposits (hereinafter short-term cost) and long-term defect deposits, we compared the values obtained in this study with the major values presented in the previous study[1].

First, in the short-term defect deposits, the repair cost related to resident complaints took a higher portion, but in the long-term defect deposits, the actual repair cost accounted for a higher portion. This may imply that the repair cost related to resident complaints increased in the short-term defect deposits due to diverse interests, including the image of the apartment complex at the early stage of sales, but the long-term defect deposits are used more for actual repair rather than for other interests. Therefore, the long-term defect deposits are assumed to have been used more appropriately for their purpose compared with the short-term defect deposits.

Second, the ratio of the repair cost related to resident complaints to the actual repair cost was shown to be similar or slightly higher in the short-term defect deposits per household and per unit area, while the ratio of the actual repair cost was higher in the long-term defect deposits per household, but this gap decreased gradually in the long-term defect deposits per unit area.

Third, in the comparison of costs actually input, it was found that the short-term defect deposit per household was KRW511,375 while the long-term

deposit per household was KRW424,578. The annual short-term deposit was KRW170,458, while the annual long-term deposit was KRW60,654, which implies that the long-term deposit was spent less than the short-term deposit. In addition, in terms of defect deposit per unit area, the short-term deposit was 7,460(won/m²) while the long-term deposit was 4,306(won/m²). In terms of annual defect deposit, the short-term deposit was 2,487(won/m²) while the long-term deposit was 615(won/m²). The differences are believed to be related to repair costs involving resident complaints, which occupied a higher portion in the short-term deposits than in the long-term deposits.

6. Conclusion

In this study, the current state of defect deposits was analyzed, and the characteristics of 4th-to-10th-year defect deposits were compared with those of 3rd-year defect deposits. The portion of the actual repair cost was higher in the long-term deposits than that of the repair cost related to resident complaints. This may imply that the short-term deposits are usually used to deal with the demands related to resident complaints while the long-term deposits are usually used more practically. However, the portion of the repair cost related to resident complaints is still high in the long-term deposits because of the gap between the actual system and the reality of expenditures. The ratio between the actual repair cost and the repair cost related to resident complaints was not greatly affected by region or by apartment size. Future studies should be focus that when a cost is incurred to a construction company, it should be synchronized with the system, and an additional analysis should be performed of the issues in the future.

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