S9-5
STUDY ON THE REASONS FOR OLD AGED APARTMENT REMODELING

Kyeong-Seok Chae[1], Jin-Gu Park[2], Chan-Sik Lee[3]

[1] Graduate Student, Department of Architectural Engineering, University of Incheon, Incheon, Korea
[2] Graduate Student, Department of Architectural Engineering, University of Incheon, Incheon, Korea
[3] Professor, Department of Architectural Engineering, University of Incheon, Incheon, Korea
200921109@incheon.ac.kr

ABSTRACT: Alongside the increasingly larger domestic construction projects is the gradual rise in construction waste. Consequently, serious environmental problems emerge. The increase in demand for housing remodeling due mainly to the increase in national income and improvement of quality of life is the main reason for the increase in construction waste. This study was conducted as the basic study for the prevention and reduction of construction waste generated by apartment remodeling; it aimed at identifying the remodeling items and reasons. Toward this end, this study targeted apartments at least 15 years old and conducted a questionnaire survey to determine the remodeled sections and remodeling reasons. As a result of the questionnaire survey, the bathroom, floor finishing, and kitchen furniture recorded the highest ratios in remodeling. Old materials, aesthetic motivation, and pleasant living space composition were cited as the major remodeling reasons. This study is significant as a basic study for generating environmental and economic profits through systematic waste management. Further studies should develop guidelines suitable for construction waste reduction and recycling in line with the construction and demolition phases in case of remodeling.

Keywords: Remodeling; Item; Construction wastes; Reduce

1. INTRODUCTION

In Korea, the construction waste generated in the construction, remodeling, and demolition phases causes serious environmental problems. Construction waste as used herein refers to 5 tons or more of waste generated by a construction project from commencement to completion as per Article 2 of the Construction Waste Recycling Promotion Act and Article 2.4 of the Framework Act on the Construction Industry. Waste less than 5 tons is regarded as domestic waste. According to the "Status of the 2004 Waste Generation and Treatment Nationwide"[1], construction waste rose sharply from 25.8% in 1998 to 48.9% in 2004. This was due to the gradual rise in the volume of construction waste alongside the expanding scale of construction projects. On the other hand, apartments meeting only the minimum residential environment criteria have been substantially introduced in an effort to address urban problems caused by rapid population inflow in the past.

The housing supply situation and residential environment criteria have changed over time, yet the apartments whose aging is in progress merely reflect the situation and criteria related to the time of their construction. Given the increase in national income and improvement in the quality of life, apartment users carry out indiscriminate remodeling including furniture replacement, finishing and decorative materials change, and facilities change aside from structural modification to address the problem of outworn materials and meet personal needs in life. Following the amendment of the Enforcement Decree of the Housing Act, the number of remodeling cases has been on the rise since the apartment age required for remodeling was reduced from 20 to 15 years after the year of construction. The increase in remodeling demand accounts in part for the augmentation of construction waste.

This study sought to determine the remodeled sections in apartment housing and remodeling reasons through a questionnaire survey among residents who remodeled their apartments among those 15 years old or over to formulate a measure for reducing the construction waste generated from remodeling in Korea.

2. METHODOLOGY

This study presented the means of reducing the construction waste generated from the remodeling of old apartments. The relevant questionnaire survey on the sections of the house for remodeling and remodeling reasons targeted apartments 15 years old or over. The questionnaire subjects were residents with remodeling experiences, with the questions covering the floor finishing materials, kitchen furniture, balcony extension, window frame, bathroom, ceiling, facilities replacement, etc. The remodeling reasons including outworn materials, aesthetic motivation, difficulty in use, spatial extension, safety, and profitability improvement were also tackled.

Table 1. Study Trends Related to Remodeling.

Author	Year	Title
Lee Mi-Jung, Ju Seo-Ryeung[2]	Apr. 2002	A study on the Development of Remodeling Items for Apartments
Hwang Kyung-Sun, Song Seung-Yeong[3]	Mar. 2004	Priority Analysis of Remodeling Programs for Improving the Financial Value of Apartment
Choi Yoon-Jung, Shim Hyun-Suk, Jeong Youn-Hong[4]	May. 2007	Actual Conditions of Remodeling in Apartment Units
Go Seong-Seok, Song Hyuk, Lee Han-Min, Lee Hyun-Chul[5]	Jun. 2007	Study on the Priority of Residents' Demands During the Apartment House Remodeling Stage Using AHP (Analytical Hierarchy Process)

3. LITERATURE REVIEW

3.1 Korean Studies

Table 1 shows the existing studies on remodeling and the relevant studies.

In terms of existing studies, Lee Mi-Jung and Ju Seo-Ryeong (2002) defined the typical outworn phenomena of apartments as physical and functional outworn phenomena. They presented step-by-step remodeling items based on the extent of remodeling demand, repair cycle, and durable years vis-à-vis the items extracted from a preceding study, i.e., "Maintenance and Improvement Situation of Old High-Rise Apartments." Hwang Kyung-Sun and Song Seung-Yeong (2004) drew and analyzed the importance per remodeling item from the economic value-added improvement aspect by segmented group according to experts after analyzing

domestic old apartments' architectural trends, related systems, and remodeling situation. Choi Yoon-Jung, et al (2007) targeted working-level people in their study and identified the status of apartment unit residential remodeling factors as part of providing practical information to designers and residents in planning apartment remodeling. Go Seong-Seok, et al (2007) investigated and analyzed users' preference and demand extent using AHP in case of apartment remodeling through assessment item extraction as considered in apartment remodeling. Although many studies have been conducted with regard to item by drawing on remodeling or resident's preference, this study was different from existing studies since it examined the remodeling sections and remodeling reasons for the prevention and reduction of construction waste generated during remodeling.

Table 2. Apartment by Age. (Unit : Thousand)

Category	Total	Sold Housing Units				Rental House
		Total	APT	Flat	Multiplex House	
Total	6,404	5,481	5,263	214	4	923
5 years or less	2,063	1,542	1,525	16	1	521
5~10 years	2,026	1,779	1,749	29	1	247
11~15 years	1,281	1,149	1,093	55	1	132
16~20 years	631	612	535	76	1	19

21 years	403	399	361	38	·	4

Table 3. Transport and Treatment of Construction Waste.

Category	Volume (m³)	Volume of Waste per Floor Area (m³/m²)
Waste loading	8,573	0.51
Transport and treatment of construction waste	7,920	0.47
Transport and treatment of general and domestic waste	653	0.04

3.2 Korea's Remodeling Market Analysis

Alongside the rapidly increasing stock of old buildings in Korea is the surging demand for remodeling to enhance building use values and asset values. In particular, various policy and technical measures are presented for the remodeling of apartments as an alternative to reconstruction. Table 2 shows apartments by age; apartments more than 15 years old as of 2005 accounted for 16% of the total number of apartments, and this figure is forecast to rise continuously [6].

3.3 Status of Waste Generation in Case of Remodeling in Korea

A case study was conducted targeting H Apartment complex located in Apgujeong-dong, Gangnam-gu, Seoul to determine the status of waste volume in case of remodeling. The apartments were made of reinforced concrete; the total floor area was 15,767.90 m², the underground total floor area, 1,186.72 m², and the total area, 16,954.62 m². Table 3 shows the transport and treatment of waste generated when remodeling the sample apartment. In terms of the waste volume per floor area,

the transport/treatment of construction waste was 0.47 m³/m²; general and domestic waste transport and treatment accounted for 0.04 m³/ m².

4. QUESTIONNAIRE SURVEY

4.1 Overview

This study targeted 550 households residing in an apartment complex located in Incheon. It conducted a questionnaire survey and collected a total of 67 responses. The questionnaire consisted of two parts: the first part dealt with the features of the respondents, and the second part covered the remodeling sections and remodeling reasons. The summary of the questionnaire survey analysis is shown in Table 4.

## 4.2 Survey Results and Analysis

Figure 1 shows the responses on the remodeling sections. Bathroom (15.4%) and floor covering (13.2%) recorded high ratios, and they were also the sections that were remodeled the most.

Table 4. Summary of the Questionnaire Survey.

Survey period		Jan. 19 ~ 24, 2009				
Completion of target apartments' construction		Feb. 1986				
No. of questionnaire responses		89.26 m²	102.48 m²	125.62 m²	152.07 m²	168.6 m²
		14	31	11	6	5
Respondent Features	No. of years of residing in apartment	1 ~ 23 years (8 years on the average)				

	Remodeling at a point in time after moving in	Immediately before moving in ~ after 20 years

Fig 1. Remodeling Sections.
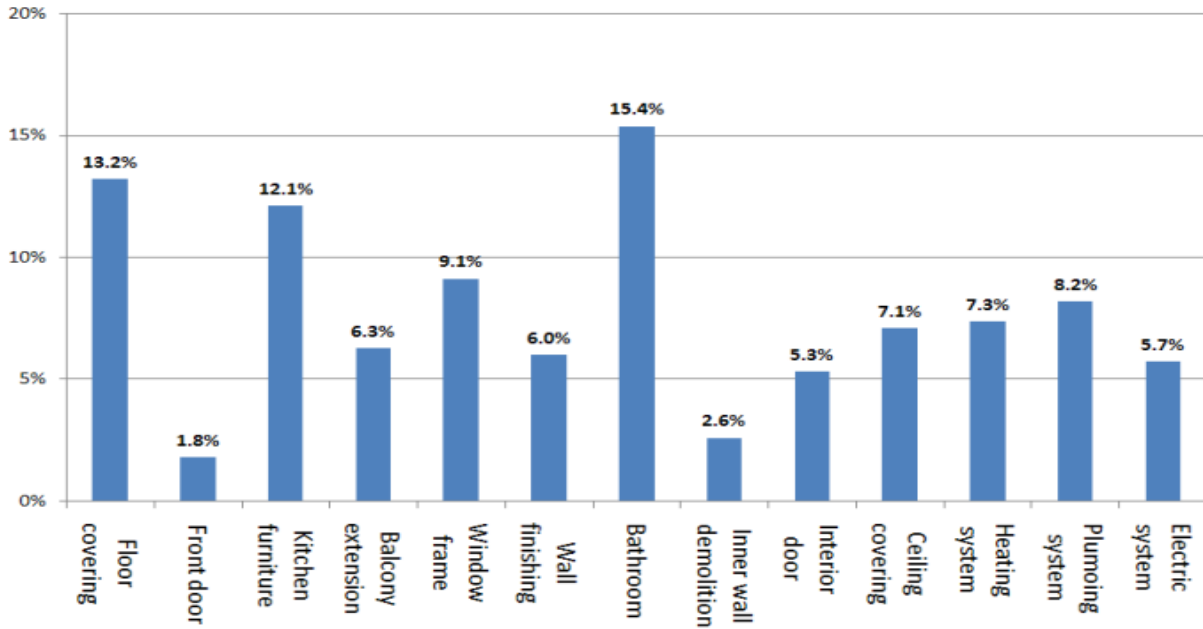
The respondents gave one or multiple responses for the reasons for remodeling. As shown in Figure 2, most cases of remodeling were due mainly to old materials (46.7%) followed by aesthetic motivation (13.7%), pleasant spatial composition (9.5%), preference for higher-quality materials (8.2%), difficulty in use (5.3%), insufficient space (4.6%), safety (4.4%), use of popular materials (3.4%), health (2.7%), and improvement in profitability of the existing building.

Table 5 shows the analysis of the remodeling sections and remodeling reasons as drawn through the questionnaire survey. The density of the remodeled sections and remodeling reasons were quantified.

Fig 2. Remodeling Reasons.

The analysis results are summarized as follows:

· The remodeling of the floor covering (13%), kitchen furniture (12%), and bathroom (16%) was carried out due to all remodeling reasons; they also recorded the highest ratios in the remodeling sections.

· In most remodeling sections such as floor covering, kitchen furniture, window frame, and bathroom, the problem of outworn materials was cited as the biggest reason. This was because the questionnaire survey was conducted 23 years after the completion of apartment construction. Therefore, outworn materials seem to be the biggest problem.
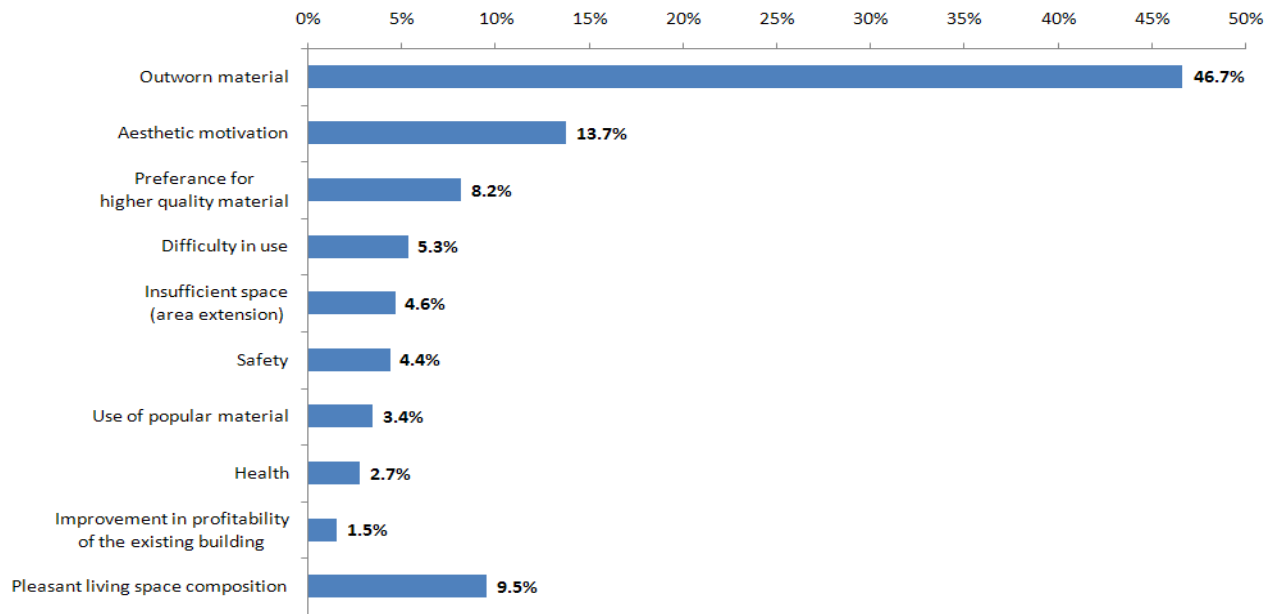
Table 5. Relationships between Remodeling Items and Reasons.

Reasons \ Items	Floor covering	Front door	Kitchen furniture	Balcony extension	Window frame	Wall finishing	Bathroom	Inner wall demolition	Interior door	Ceiling covering	Heating system	Plumping system	Electric system	Total	Ratio (%)
Outworn materials	41	3	46	12	38	21	39	4	19	22	35	38	25	343	47
Aesthetic motivation	12	2	13	2	8	13	21	1	8	17	1	1	2	101	14
Preference for higher-quality materials	15	1	8	2	7	5	10		2	4	2	3	1	60	8
Difficulty in use	2		5		2		10	3			6	7	4	39	5
Insufficient space (area extension)	2		1	20			4	6	1					34	5
Safety	1	6	1		3		3		3		4	4	7	32	4
Use of popular materials	8		5		3	1	3		1	3	1			25	3
Health	3		1		1		7				3	5		20	3
Improvement in profitability of the existing building	3		1	3			1		1		1	1		11	1
Pleasant living space composition	10	1	8	7	5	4	15	5	4	6	1	1	3	70	10
Total	97	13	89	46	67	44	113	19	39	52	54	60	42	735	100

Ratio (%)	13	2	12	6	9	6	16	3	5	7	7	8	6	100	

・For the front door (2%), it recorded the lowest ratio in terms of remodeling sections; neither was it tackled in other reasons. Note, however, that safety as a reason had the highest ratio at 46%. The front door is hardly related to old materials, yet the replacement of the front door has been carried out for safety reasons, i.e., because of the recent social concern and anxiety.

・Wall finishing (6%), interior door (5%), and ceiling covering (7%) recorded high ratios in the remodeling sections; their remodeling was carried out due mainly to old materials. In contrast, the ratios of floor covering, kitchen furniture, and bathroom were higher than wall finishing, ceiling covering, and interior door in apartment remodeling.

・Although remodeling was carried out for heating, plumping, and electric system regardless of the insufficiency of space (area extension), the balcony extension recorded the highest ratio with approximately 43% for the remodeling reasons. This seemed to be the result of acquiring bigger residential space by extending the existing balcony as a living space. On the other hand, the criteria for structure modification procedure and installation have been officially announced as per Construction and Transportation Ministry (Current MLTM) Notice No. 2005-400.

・Inner wall demolition (3%) was slightly higher than the lowest front door (2%); area extension recorded the highest ratio in the remodeling reasons. In the case of inner wall demolition, however, it could bring about a change in living space unlike floor/ceiling covering or furniture replacement. As such, respondents apparently had a hard time making the decision.

・With regard to the remodeling reasons, old materials (47%), aesthetics motivation (14%), and pleasant living space composition (10%) were reflected in all types. The result showed the remodeling trend of respondents residing in old apartments.

・The improvement in profitability of the existing building (1%) recorded the lowest ratio, whereas the corresponding remodeling sections such as floor covering and balcony extension had the highest ratio at 27% each. Most respondents seemed to carry out remodeling for better living rather than for profitability improvement of the existing apartments.

5. CONCLUSIONS

The construction waste generated through apartment remodeling in Korea causes various problems. Pollution resulting from construction waste has a negative impact on the environment, and it is accompanied by economic loss. Therefore, construction waste itself should be prevented as a priority, and activities for the reduction and recycling of construction waste should be implemented. This study examined the remodeling sections and remodeling reasons for the reduction of construction waste volume generated in case of apartment remodeling. Based on the questionnaire survey results, the bathroom, floor finishing, and kitchen furniture recorded the highest ratios as remodeling items; outworn materials, aesthetic motivation, and pleasant living space composition had the highest ratios as remodeling reasons. As further studies, reinforcing the logic of the questionnaire items drawn in this study and adding statistical verification in the analysis process of the questionnaire survey results are required.

Finally, appropriate guidelines for construction waste reduction and recycling should be developed in line with the construction and demolition phases in apartment remodeling.

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