

The Status and Characteristics of Housing Performance by the Analysis of Recognition Cases of Housing Performance Grading Indication in Korea

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ABSTRACT: This research is aiming at finding out the status and characteristics of domestic housing performance by the analysis of 47 sites that were applied for the recognition of housing performance grading indication system. As a result of analyzing the applied sites, in the case of noise related grading, noise emission in bathroom and airborne sound insulation for wall between units were assessed high, but light-weight floor impact sound insulation and heavy-weight floor impact sound insulation were assessed low. Long-life housing related grading was assessed low mostly. Environment related grading was applied to most sites with improved performance. In the case of living environment grading, community facilities were actively applied, but the application of facilities for the aged person were low. In the case of fire & fire prevention grading, it was found that most sites were satisfied by the laws and regulations. Because housing is the complex with synthetic performances and the substance can be found out accurately after passing over long time, the assessment in current design stage cannot represent the synthetic performance level of housing.

Keywords: Housing performance, Grading indication, Recognition

1. INTRODUCTION

For national environment conservation and resources savings, housing policy is being changed from quantitative supply policy to qualitative policy. Comprehensive improvement of quality and performance of housing is the important factor to attract sound development of housing industry by securing stock in quality in national level as well as satisfying resident's requirements. Under the situation not having objective and unified judgment standard for housing performance, there was the limitation to

compare and select desired house as it was by common people, not by housing expert.

Furthermore, conflict occurred since one house with synthetic performance could not be indicated with synthetic and unified performance. Accordingly, the government sought the introduction of housing performance grading indication system as a substantial plan to improve distrust and inconvenience suffered by people due to defects or insufficiency of performance that occurred after housing distribution.

Housing performance grading indication system is aiming at protecting consumer by consumer's finding a house with unified

performance items for securing stock in good quality nationwide and performance conformed to objective standard in advance, comparing and selecting the house. Furthermore, housing construction companies can induce and promote performance improvement and technological development based on the standard of housing performance grading indication system and be assessed by consumers accurately since they can show the performance to consumers according to definite standard.

This research is aiming at grasping the status of housing performance grading of apartment housing in Korea through the status of the cases completed to be recognized for activating the said system.

2. The Scope and Method

Data collection was made for 47 cases (sites) recognized by housing performance grading indication from January 9, 2006 to June 31, 2008. Applied total sites (sound insulation related grading, long-life housing related grading, fire & fire prevention grading: 47 cases; environment related grading, living environment grading: 35 cases) were classified per performance section and focused to grasp and analyze the status of performance, and each performance was described objectively.

3. The Overview of Grading in Housing Performance Grading Indication System

Housing performance grading indication system is the assessment in design stage for the newly built housing and it is classified into 5 performance sections such as sound insulation related grading, long-life housing related grading, environment related grading, living environment grading, and fire & fire prevention grading, 14 performance categories and 20 performance items. Each performance items set with grade 1~3 or grade 1~4 according to the characteristics; grade 1 is

the most superior grade, and the bigger the number goes, the lower the grade is. If the laws and regulations exist, the standard of the laws and regulations was applied to the lowest grade, or if there was no laws and regulations, general standard was considered to be conformed to the lowest grade, and higher grade set per performance category for the degree to be attained in the near future in consideration of current technology development or situation. It was reviewed that there would be a possibility to abandon technological development if too high standard set, and not to make efforts for technological development, if too low standard set. In the case that accurate housing performance can be drawn out quantitatively by formula or computation, the performance was indicated with numerical values. If the performance could not be indicated quantitatively or difficult to be indicated, qualitative index was enumerated or the scores with weight per item were used for standard.

4. The Characteristics per Performance Section through the Recognition of Housing Performance Grading

4.1 The status of Sound insulation related grading

Sound insulation related grading is classified into light-weight floor impact sound insulation, heavy-weight floor impact sound insulation, noise emission in bathroom, and airborne sound insulation for wall between units. The purpose of performance grading indication of light-weight floor impact sound insulation is to provide comfortable residence space to resident by securing interception performance of light-weight floor impact sound that is delivered down to lower floor through floor structure. Standard floor structure is assessed as grade 4. Structures except standard floor structure are assessed

using written recognition of performance. 2 sites were assessed as grade 1, 9 sites as grade 2, 9 sites as grade 3, and 27 sites as grade 4 in total 47 sites. Light-weight floor impact sound insulation was assessed as low grade because applied sites adopted standard floor structure in most cases.

Table I: The recognition of light-weight floor impact sound insulation

Grade	1	2	3	4	Total
Number of Sites (%)	2 (4%)	9 (19%)	9 (19%)	27 (58%)	47 (100%)

The purpose of heavy-weight floor impact sound insulation is to secure interception performance of heavy-weight floor impact sound delivered down to lower floor through floor structure. 12 sites were assessed as grade 3, 35 sites as grade 4 in total 47 sites.

Heavy-weight floor impact sound insulation was assessed as low grade because it adopted standard floor structure as well as light-weight floor impact sound insulation.

Table II: The recognition of Heavy -weight floor impact sound insulation

Grade	1	2	3	4	Total
Number of Sites (%)	0 (0%)	0 (0%)	12 (26%)	35 (74%)	47 (100%)

The purpose of noise emission in bathroom insulation is to secure calmness of indoor space by attracting the adoption of reduction engineering related to air propagation sound between upper floor and lower floor through delivery noise in bathroom and air duct. Scores of adopted noise reduction engineering summed up and assessed by classifying into 4 grades. 4 sites were assessed as grade 1, 42 sites as grade 2, 1 site as grade 3 in total 47 sites.

Table III: The recognition of Noise emission In bathroom

Grade	1	2	3	4	Total
Number of Sites (%)	4 (9%)	42 (89%)	1 (2%)	0 (0%)	47 (100%)

Most applied sites were assessed as high grading since the application of reduction engineering related to noise emission in bathroom was easy.

The purpose of airborne sound insulation for wall between units is to evaluate noise interception capability to wall between units to create comfortable residence space and secure privacy. 5 sites were assessed as grade 1, 33 sites as grade 2, and 9 sites as grade 3. Airborne sound insulation for wall between units was assessed slightly higher grading due to the increase of wall thickness since slab thickness was increased.

Table IV: The recognition of Airborne sound insulation for wall between units

Grade	1	2	3	Total
Number of Sites (%)	5(11%)	33(70%)	9(19%)	47(100%)

4.2 The status of Long-life housing related grading

Long-life housing related grading is classified into flexibility, repair feasibility (remodeling & maintenance) and durability.

The purpose of flexibility is to evaluate the degree of response possibility for resident's requirement for space flexibility at exclusive space in household unit. It was assessed as 4 grades according to durability wall in exclusive area and length proportion of column. 1 site was assessed as grade 1, 9 sites as grade 2, 8 sites as grade 3, and 29 sites as grade 4. In the case that building structure is durability wall type, the grading was assessed lower, but the site applying frame structure with reinforced concrete and complex structure was assessed higher.

Table V: The recognition of Flexibility

Grade	1	2	3	4	Total
Number of Sites (%)	1 (2%)	9 (19%)	8 (17%)	29 (62%)	47 (100%)

It was found that frame structure, which was easy to make flexible space, was being applied to housing in Korea.

Repair feasibility (remodeling & maintenance) is classified into exclusive use section assessment for evaluating checkup for inner composition materials at exclusive space and feasibility of repair or replacement, and public section assessment for evaluating durability of piping and wiring at public space and maintenance.

On private space, 3 sites were assessed as grade 3, 41 sites as grade 4. On common space, 1 site was assessed as grade 2, 16 sites as grade 3, and 30 sites as grade 4. Checkup for exclusive section and feasibility of repair and replacement were assessed lower in most cases. On public use section, securing room for remodeling and repair of public piping and wiring and layout plan were assessed as slightly higher grading. In case of exclusive use section, it was found that remodeling and maintenance were not being made.

Table VI: The recognition of Remodeling & Maintenance

Grade	1	2	3	4	Total
Number of Sites (%) - Private Space	0 (0%)	0 (0%)	3 (7%)	41 (93%)	44 (100%)
Number of Sites (%) - Common space	0 (0%)	1 (2%)	16 (34%)	30 (64%)	47 (100%)

The purpose of durability is to extend life of building through high durability plan. Durability was assessed through durable years (physical life). 8 sites were assessed as grade 2, 39 sites as grade 3 in total 47 sites.

It was found that most sites conformed to general guidelines of standard specification of building construction.

Table VII: The recognition of Durability

Grade	1	2	3	Total
Number of Sites (%)	0(0%)	8(17%)	39(83%)	47(100%)

4.3 The status of Environment related grading

Environment related grading is classified into landscape (external environment), day

light (light environment), indoor air quality & ventilation, and energy performance (thermal environment).

Landscape is classified into external space for quantitative assessment of ecological function (natural circulation function) and naturality & preservation of natural grounds to evaluate ecological function of building exterior and afforestation ratio of natural grounds. In the case of environment related grading, 35 sites were applied. In the case of ecological function of external space and building exterior, 5 sites were assessed as grade 1, 12 sites as grade 2, 11 sites as grade 3, and 7 sites as grade 4. In the case of naturality & preservation of natural grounds, 6 sites were assessed as grade 1, 8 sites as grade 2, 12 sites as grade 3, and 9 sites as grade 4. Grading of ecological area ratio was assessed high due to the enhancement of requirements for external environment (landscape) and improvement of quality level, and securing natural grounds afforestation is considered as one of alternatives for securing ecological area ratio.

Table VIII: The recognition of Landscape

Grade	1	2	3	4	Total
Number of Sites (%) - Ecological function of the external space & building exterior	5 (14%)	12 (35%)	11 (31%)	7 (20%)	35 (100%)
Number of Sites (%) - Naturality & preservation of natural grounds	6 (17%)	8 (23%)	12 (34%)	9 (26%)	35 (100%)

The purpose of daylight (light environment) is to increase the lighting efficiency of building by evaluating the ratio of lighting window applying weight per direction. 3 sites were assessed as grade 1, 10 sites as grade 2, 18 sites as grade 3, and 4 sites as grade 4. To realize comfortable environment, reviewing on daylight and lookout were being made in site layout plan and light environment was assessed as high

grading due to securing maximum distance between buildings.

Table IX: The recognition of Daylight

Grade	1	2	3	4	Total
Number of Sites (%)	3 (9%)	10 (29%)	18 (51%)	4 (11%)	35 (100%)

Indoor air quality is classified into application of low emitting building materials for indoor air quality to evaluate the degree of application of low emitting building materials for indoor air quality and ventilation performance for household units to evaluate securing minimum ventilation volume to maintain comfortable indoor air and ventilation performance over fixed level.

On low emitting building materials for indoor air quality, 17 sites were assessed as grade 1, 14 sites as grade 2, 4 sites as grade 3. On ventilation performance for household units, 3 sites were assessed as grade 1, 22 sites as grade 2, and 10 sites as grade 3.

Grading was assessed high since low emitting building materials were actively applied due to the increase of resident's requirement for indoor air environment, and the site in which appropriate ventilation facilities were installed was assessed as high grading.

Table X : The recognition of Indoor air quality

Grade	1	2	3	Total
Number of Sites(%)- Application of low emitting building materials for indoor air quality	17 (49%)	14 (40%)	4 (11%)	35 (100%)
Number of Sites(%)- Ventilation performance for household units	3 (9%)	22 (62%)	10 (29%)	35 (100%)

The purpose of energy performance is to evaluate the marks of energy performance (thermal environment) and the energy efficiency of building. It was assessed by the scores estimated by energy saving plan or grading estimated by the recognition standard of building energy efficiency grading. 8 sites were assessed as grade 2, 25

sites as grade 3, and 2 sites as grade 4 in total 35 sites. It was found that interest in energy saving was being increased.

Table XI : The recognition of Energy performance

Grade	1	2	3	4	Total
Number of Sites (%)	0 (0%)	8 (23%)	25 (71%)	2 (6%)	47 (100%)

4.4 The Status of living environment related grading

Living environment grading is classified into common resident facilities such as playground etc and consideration for the socially underprivileged such as the aged etc.

The purpose of common resident facilities is to provide wide area of common facilities to resident by securing common resident facilities such as playground for children, hall for the aged, nursery for infants, and library. 24 sites were assessed as grade 1, 5 sites as grade 2, 4 sites as grade 3.

It was assessed as high grading in most sites due to the increase of area for common resident facilities.

Table XII : The recognition of Common resident facilities such as playground etc

Grade	1	2	3	Total
Number of Sites (%)	24 (73%)	5 (15%)	4 (12%)	47 (100%)

Consideration of the socially underprivileged such as the aged etc is classified into exclusive section and public section for securing feasibility of movement by the socially underprivileged such as the aged, disable person, or pregnant woman and security of life. On exclusive use section, 3 sites were assessed as grade 2, 32 sites as grade 3. Exclusive use section was assessed as much as satisfying legal level in most cases. On public use section, 4 sites were assessed as grade 1, 13 sites as grade 2, and 18 sites as grade 3. Public use section was also the level to satisfy the laws and regulations. Therefore, it is necessary to improve the performance level at the design

step in response to the aging society in the future.

Table XIII :The status of recognition of Consideration for the socially underprivileged such as the aged etc

Grade	1	2	3	Total
Number of Sites (%) - private space	0 (0%)	3 (9%)	32 (91%)	35 (100%)
Number of Sites (%) - common space	4 (11%)	13 (37%)	18 (52%)	35 (100%)

4.5 The status of Fire & Fire prevention grading

On fire & fire prevention grading, fire & fire prevention are applied to performance category and classified into fire detection & warning facilities, smoke release & evacuation facilities, and fire resistance performance. On fire detection & warning facilities, 15 sites were assessed as grade 2, and 32 sites as grade 3. Fire detection & warning facilities were assessed high due to additional installation of fire facilities. On smoke release & evacuation facilities, the level was just satisfying the laws and regulations. On fire resistance performance, 2 sites were assessed as grade 1, 13 sites as grade 2, and 32 sites as grade 3. Fire resistance performance was assessed high due to the increase of concrete covering thickness.

Table XIV :The recognition Fire & Fire prevention grading

Grade	1	2	3	Total
Number of Sites (%) - Fire detection & warning facilities	0 (0%)	3 (32%)	32 (68%)	35 (100%)
Number of Sites (%) - Smoke release & evacuation facilities	0 (0%)	2 (4%)	45 (96%)	35 (100%)
Number of Sites (%) - Fire resistance performance	2 (4%)	13 (28%)	32 (68%)	35 (100%)

5. Conclusion and Suggestion

As a result of analyzing the recognition cases of 47 sites, completed the recognition of housing performance grading, it was

found that various grading distribution was shown in performance items per site. On sound insulation related grading, noise emission in bathroom and airborne sound insulation for wall between units were high levels but light-weight floor impact sound insulation and heavy-weight floor impact sound insulation were assessed high. Long-life housing related grading was assessed low in most sites. Environment related grading was classified into the case of evaluating household unit interior and evaluating site, and it was found that improved performance was applied in most sites. On living environment related grading, community facilities in the site were being actively applied but the application for the aged was low. On fire & fire prevention grading, it was found that most sites were satisfied by the laws and regulations.

As housing is the complex with synthetic performances and the substance can be found accurately after passing over long time, the analysis of the recognition status of housing performance grading indication system cannot represent synthetic performance level of housing. Therefore, if construction assessment of housing in the future is made together, the housing performance can be definitely assessed.

REFERENCES

- [1] Kim, S.A., Cho, D.O., Yang, K.S., Kim, H.S., and Lee, S.O., 2005. The study on the apartment housing performance grading indication system. Korea institute construction technology, pp67-272. Korea
- [2] Lee, S.O., and Kim S.A. 2007. Housing Performance Garding Indication System of Korea. Sustainable building technology. pp1291-1296. Korea
- [3] Building center of Japan, 2005. The housing quality assurance act and Japan housing performance indication standards. pp84-135. Japan