

A Study on the Reasonable Daylight Assessment Method and Building Code

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ABSTRACT: The apartment buildings now cover more than 50% of the total residential types in Korea and the urban residential area becomes increasingly congested with newly constructed high-rise apartment buildings. Disputes are increasing, however, on infringed solar rights for the neighbouring structures as cases occur where the requirement cannot be satisfied in congested residential areas. So, Korean Building Code restricts 1) the building-to-land ratio 2) floor space 3) height limit and so on. Especially judicial precedents requires, for securing the solar rights in the residential area, that the consecutive sunshine duration should be at least two hours from 9:00 to 15:00 or the accumulative sunshine duration should be at least four hours from 8:00 to 16:00 as of the winter solstice.

The objective of this study is to analyze the sunshine duration, to classify according to building type, shape and height from case studies and to provide the reasonable daylight assessment method and code.

Keywords: high-rise apartment building, solar rights, sunshine duration, assessment method

1. INTRODUCTION

Daylight is essential for the ideal life and residence of human. The right to enjoy sunshine is one of the basic inalienable rights. So it is evaluated in many assessment tools. KGBC assess "Daylight" on the daylight duration (at least consecutive two hours from 9:00 to 15:00 or accumulative four hours from 8:00 to 16:00 as of the winter solstice). However, HPIS estimate it at the concept of "window area rate", "window direction" and "distance between buildings". Thus, daylight assessment method is analyzed by case study and the reasonable daylight assessment method is to provided.

2. POLICEIS CONSIDERATION

2.1 Green Building certification system

The purpose of the green building certification system is to save resources and reduce pollutants in all processes from production of building materials, design, construction, maintenance and scrapping, and evaluate elements affecting the environment, thereby improving the environmental performance of buildings and reduce energy consumption and emission of greenhouse gases.

From October 1999 to December 2000 the Ministry of Energy and the Ministry of Construction & Transportation enforced the certification system for demonstration purposes, and in 2001 the guideline for integrated enforcement of the green building

certification was prepared, and the system has been applied to apartment houses since January 2002. Currently finished buildings will be examined for certifications are issued. The certification will be valid for 5years, and can be extended for another

5years, but after 10 years re-application must be made. Right now apartment houses, residential-cum-commercial buildings, office buildings, and school buildings are subjected to this certification system.

Table I: Items of Evaluation (Green Building certification system)

Category	Planning objective		Assessment criteria		Category	Planning objective		Assessment criteria	
1. Land use	1.1	Ecological value	1.1.1	Ecological value of existing landscape	5. Water resource	5.1	Water cycling system	5.1.1	Rainwater load reduction plan
			1.1.2	Preserved rate of existing natural resource		5.2	Reduced water resource consumption	5.2.1	Water use reduction plan
	1.2	Land utilization	1.2.1	Floor area ratio				5.2.2	Rainwater use
			1.2.2	Systematically upper level plan				5.2.3	Wastewater reclamation and reusing system
	1.3	Influence on nearby area	1.3.1	Appropriateness of protecting light pollution to nearby area	6. environmental pollution	6.1	Global warming prevention	6.1.1	CO2 emission reduction
	1.4	Comfortable housing environment	1.4.1	Community center and facilities	7. Operation & management	7.1	Site management	7.1.1	Environment management plan in construction
			1.4.2	Construction of pedestrian only roads		7.2	Efficient management plan	7.2.1	Offered operation & management document and guideline
			1.4.3	Connection of network to outer pedestrian only roads		7.3	Efficient unit management	7.3.1	User's manual
2. Transportation	2.1	Transportation load reduction	2.1.1	Accessibility to public transportation	8. Ecological environment	8.1	Green space securing	8.1.1	Continuous green axis
			2.1.2	Pedestrian and bicycle only road construction				8.1.2	Green space rate
			2.1.3	Information network and high technology life facility adoption				8.1.3	Artificial afforestation considering ecological environment
			2.1.4	Average distance between urban area and complex center		8.2	Living habitat development	8.2.1	Water biotope development
3. Energy	3.1	Energy consumption	3.1.1	Energy consumption amount				8.2.2	Ground biotope development
	3.2	Energy consumption minimization	3.2.1	Alternative energy use		8.3	Existing ecological resource recycling	8.3.1	Topsoil recycling
4. Material	4.1	Reduced resource consumption	4.1.1	Unit plan development considering change of life-cycle	9. Indoor environment	9.1	Indoor air environment	9.1.1	Indoor air pollution reduction
			4.1.2	Environmental friendly product use				9.1.2	Ventilation system
	4.2	Waste minimization	4.2.1	Reduce material for furniture		9.2	Thermal environment	9.2.1	Automatic thermostat installation of each room
	4.3	Waste reduction	4.3.1	Separate garbage collection of reusable waste		9.3	Acoustic environment	9.3.1	floor impact sound insulation
			4.3.2	Food waste reduction				9.3.2	Airborne sound insulation for wall between units
	4.4	recycling	4.4.1	Use green material				9.3.3	Acoustic environment
			4.4.2	Reuse existing building's material(main structure)		9.4	Sunshine environment	9.4.1	Indoor sunshine securing rate
			4.4.3	Reuse existing building's material(interior)		9.5	Consideration for the socially under privileged such as the aged etc.	9.5.1	Consideration for the socially under privileged such as the aged etc.

Table II : Items of Evaluation

Grade	Indoor sunshine securing rate	Weight
1	$V \geq 80\%$	1.0
2	$75\% \leq V < 80\%$	0.8
3	$70\% \leq V < 75\%$	0.6
4	$65\% \leq V < 70\%$	0.4
5	$60\% \leq V < 65\%$	0.2

2.2 Housing Performance Indicator system

The purpose of Housing performance Indicator System is to protect consumers while encouraging and promoting performance improvement and technological development of housing by allowing consumers to easily choose housing that has unified performance items and performance based on objective standards. Therefore, high quality stocks can be established. First is to protect consumers

by informing of housing performance in advance so that they can choose desirable housing through simple comparison of housing performances.

With the introduction of Housing Performance Indicator System, housing consumers may choose their desired housing by comparing each performance item form an unified standard companies provide unilaterally. Such standard would be presented through national standards indicated in performance grading, consumers would easily see what company has higher performance on what performance item, as well as understanding which housing excels compared to others in the performance item oneself needs. Consumers are given an opportunity to make objective conclusion on the level of housing performance and finalize their decision with peace of mind by selecting suitable housing for them through comparison.

Table III: Items of Evaluation (Housing Performance Indicator system)

Performance Section	Performance category		Performance Assessment Grading			
Sound insulation related grading	Light-weight floor impact sound insulation		1	2	3	4
	Heavy-weight floor impact sound insulation		1	2	3	4
	Noise emission in bathroom		1	2	3	4
	Airborne sound insulation for wall between units		1	2	3	
Long-live housing related grading	Flexibility		1	2	3	4
	Renovation & Maintenance		1	2	3	4
			1	2	3	4
	Durability		1	2	3	
Environment related grading	Landscape(External Environment)	Ecological function of the external space & building exterior	1	2	3	4
		Natural & preservation on natural grounds	1	2	3	4
	Daylight(Light Environment)		1	2	3	4
	Indoor air quality & Ventilation	Application on low emitting building materials for indoor air quality	1	2	3	
		Ventilation performance for household units	1	2	3	
	Energy performance(Thermal Environment)		1	2	3	4
Living environment grading	Common resident facilities such as playground etc.		1	2	3	
	Consideration for the socially under privileged such as the aged etc.	Private space	1	2	3	
		Common space	1	2	3	
Fire & fire prevention grading	Fire & fire prevention grading	Fire detection & warning facility	1	2	3	
		Smoke release & evacuation facility	1	2	3	
		Fire resistance performance	1	2	3	

Second is the goal of encouraging housing construction companies to focus on performance improvement and technological development of housing based on the indication standard of Performance Indicator System.

From the housing construction companies' perspective, the common, unified index of Performance Indicator System would allow the companies to get a clear understanding of performance by evaluating housings currently under construction with objective standards on unified items to find out the actual level of housing performance. Also, companies would receive more accurate evaluation from consumers by presenting performance based on the clearly indicated standards. What's more, the housing market would compete against one another to develop housing with better performance level in order to capture superiority in the market. Such competition would eventually lead to technological competition, which would then result in performance improvement of housing and construction of excellent housing, thus the excellency of housing performance could be utilized as consumer marketing strategies.

Table IV: Daylight Rate (Housing Performance Indicator system)

Grade	Daylight Rate
1	Over 1.0
2	0.8 ~ 1.0
3	0.6 ~ 0.8
4	Less than 0.6

3. CASE STUDY

3.1 Housing complex summary

This housing complex is 29 story building, 1122 unit and mixed tower-type and plate-type. So it is very effective to compare two assessment tools.



Figure 1: Bird's-eye-view and site plan

Table V: Housing complex summary

Site area	41,448 m ²
Floor area	148,427 m ²
Floor area rate	274.34%
Story	29
Unit number	1,122

3.2 Result

This housing complex is out of grade in Green Building certification system and Grade-3 in Housing Performance Indicator system.

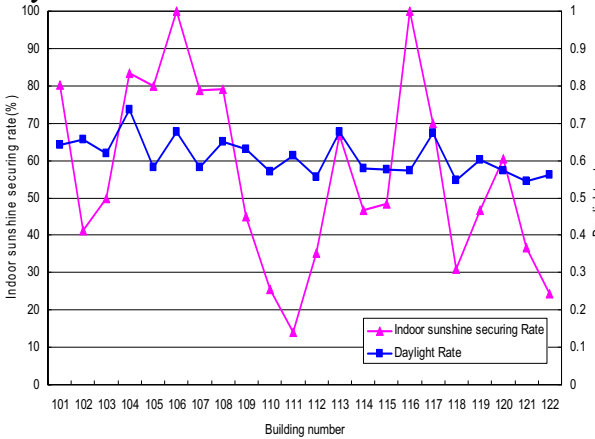


Figure 2: Analysis result comparison

Table VI: Analysis result

Building No.	Total unit	Indoor sunshine securing rate		Daylight Rate
		More than 2 hours	Rate(%)	
101	53	42	80.2	0.643
102	58	24	41.4	0.655
103	24	12	50	0.619
104	24	20	83.3	0.737
105	60	48	80	0.582
106	30	30	100	0.676
107	57	45	80.6	0.581
108	48	38	79.2	0.650
109	60	27	45	0.631
110	55	14	25.5	0.571
111	72	10	13.9	0.613
112	34	12	35.3	0.556
113	30	20	66.7	0.676
114	60	28	46.7	0.578
115	60	29	48.3	0.576
116	20	20	100	0.573
117	50	35	70	0.672
118	58	18	31.0	0.546
119	58	27	46.6	0.603
120	96	58	60.4	0.574
121	71	26	36.6	0.543
122	45	11	24.4	0.561
Total	1122	594	52.9	0.602
Grading			(Out of grade)	3

4. CONCLUSION

This paper compared daylight assessment tools between Korean Green Building Certification System (KGBC) and Housing Performance Indicator System (HPIS). The results are follows: 1) KGBC's daylight assessment result is more detail, which is influenced the floor level of the buildings. 2) The grading results are different in the same building complex.

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