

A Study on the Preliminary Assessment Standards for the Development of Ecological Outdoor Spaces of Housing Complexes

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ABSTRACT: The purpose of this experiment is to derive the element of evaluation based on the assessment standards in order to value the ecological outdoor spaces of housing complexes. In order to achieve the satisfying results, the assessment indicator system was developed based on the examples of previous experiments which explored the importance of 4 basic theories of ecological outdoor space; Circulation, Stability, Independence and Diversity. In addition, the example of assessment standards developments and domestic and foreign environmentally friendly classification criteria was analyzed. Hereafter, based on these elements of evaluation, the assessment standards and methods will be developed to assess the ecological outdoor space through investigation of citizens, professionalism and workshop as well as further research.

Keywords: Ecological housing, Outdoor space of housing complexes, Assessment standard, Classification criteria

1. INTRODUCTION

Korea initiated the development of Green Building Certification Criteria in 2002, and 215 green buildings have received the preliminary certification or certification from the Green Building Certification Criteria by 2006. Among these 215, housing buildings place the biggest portion by 171 complexes. Also its rate is still increasing rapidly (see Figure 1). This depicts that the environmental development became more active sponsored by government's expanded incentives for the Green Building Certification and the domestic interests have grown bigger on the improvements on the living environment quality.

However, it is common to see that the assessments are focused on the residents living habits. The assessments are examined

on the simple facts only. It is time for the nations to pay more recognition towards the Green Building Certification with improving on the ecosystem of outdoor space of housing complexes after it has been 5 years since it was introduced in Korea.

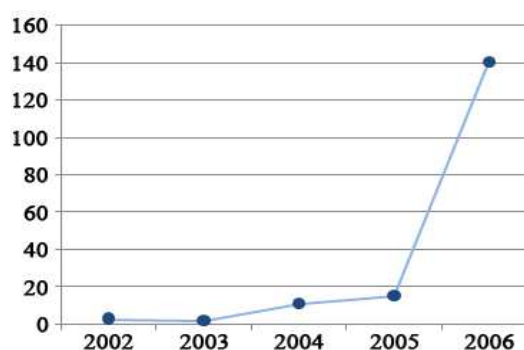


Figure 1: Number of certificated housing complexes from the Green Building Certification Criteria

Therefore this study will explain the results of the previous experiments and improvements the assessment systems according to the experts' survey results on the level of indicators and the preliminary assessment indicators. In addition, the study will focus on investigating the assessment standards to be better.

2. ESTABLISHING ECOLOGICAL OUTDOOR SPACE OF HOUSING COMPLEX ASSESSMENT INDICATORS

2.1 4 principals of Ecosystem

The 4 principals of ecosystem; Circulation, Stability, Independence and Diversity are the foundation of the research. First of all, the Circulation is the key to the constancy of ecosystem, and it balances the ecology resources and substances. The relevance to this issue had been selected as water circulation, energy circulation, and resource circulation. Secondly, the Stability is needed to sustain the stem of ecosystem from changing by the inner or outer problems of the ecosystem. The water resource stability, ecosystem stability, air-quality, sound-environment stability, and micro-climate stability are the recognized for stability kinds. Thirdly, the Independence helps the ecosystem to be self-growing without the external assistance. It makes the ecosystem to be self sufficient in supply and demand. There are water independence, energy independence, and resource independence. Lastly, Diversity maintains the abundance of ecosystem. It creates the mono-ecosystem and prospers the variety of species. There are species diversity, water system diversity, and energy source diversity.

2.2 The assessment Indicator of Ecological Outdoor Spaces of Housing Complexes

Preliminary indicators pool was established which consists of 30 assessment items and 78 assessment indicators based on

the main issues of the 4 principals of ecosystem based on the opinions and debates of experts. Then the importance of preliminary indicators pool was examined through the surveys of expertise from the architecture and landscape design.

The development of the assessment indicator of ecological outdoor spaces of housing complexes, based on the assessments of importance was executed concurrently with the research considering the phases and efficiency of the selection of assessment items and the research of the selecting the assessing standards for assessment items. According to the result from the research, the final 14 main issues, 21 assessment items, and 41 indicators which are categorized into 33 assessments about 4 principals of ecosystem have been selected. (see Table I)

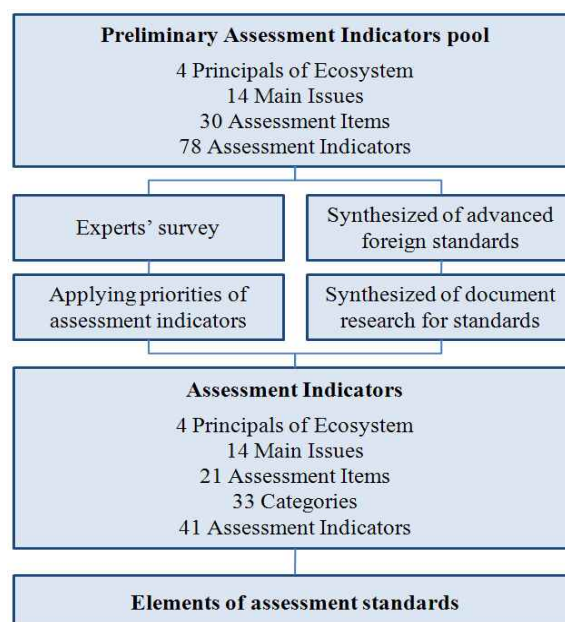


Figure 2: Research process

3. RESEARCH TENDENCY

3.1 Global research trend

According to the EcoHomes2006 from the British green building certification criteria, BREEAM, the external lighting, NOx emissions, external potable water use, ecological value of site, and protection

Table I: Assessment indicators of ecological outdoor spaces of housing complexes

4 Principals of Ecosystem	Issues	Items	Categories	Indicators
Circulation	Water circulation	Rainwater permeability	Water permeability	Water permeability pavement area
			Rainwater penetration facilities	Creation of water storage, Capacity of water penetration facilities
		Water-circulation in housing complexes	Gray water treatment	Gray water reusing facilities
	Energy circulation	Energy recycle	Use of drain-water heat	Drain-water heat reusing facilities
			Use of incinerating heat	Waste incinerating heat using
	Resource circulation	Waste recycle	Separate garbage collecting	Separate garbage collecting facilities
			Organic waste management	Composter installation
			Reuse of construction waste	Construction waste reusing ratio
Stability	Water resource stability	Quality of water	Natural water purification	Area of natural water purification, Treatment facility for nonpoint source
			Natural sewage purification	Capacity of natural sewage purification
		Prevention of disasters	Water reservation area	Capacity of water reservation area
	Ecosystem stability	Surface soil preservation	Surface soil preservation	Preservation and reuse of existed surface soil
		Topography preservation	Topography preservation ratio	Use of natural topography and existing hill areas
		Stable habitat	Creation of biotope	Creation area of aquatic/land biotope
			Suitable choice of species of trees	Choice of suitable species of trees to space's purpose
			Green network	Plan to connect complex's inner green area with external green area
	Air-quality stability	Air Quality	Natural air purification	Site plan considered wind way, Planting area connecting with parking facilities
	Sound-environment stability	Noise control	Noise control using natural materials	Green buffer zone, Plot planning considering noise point
	Micro-climate stability	Reduction of heat island effect	Insolation control by planting	Heat load considered planting
			Rainwater evapotranspiration area	Rate of green and water spaces
Independence	Water independence	Use of rainwater & gray water	Use of rainwater/gray water	Rainwater use ratio, Gray water use ratio
	Energy independence	Use of alternative energy	Use of solar energy	Capacity of solar power generation, Heating with solar collector
			Wind power plant	Use of wind turbine generation
			Use of geothermy	Using geothermy for air-conditioning and heating
	Resource independence	Vegetables/fruit growing	Area of agricultural land	Vegetable garden and fruit trees area
		Recycling facilities	Creation of recycling facility	Recycling facility plan
Diversity	Species diversity	Green space	Preservation of existing green area	Rate of existing green area preservation
			Ecological planting	Proper density to planting
			Green areas on artificial ground	Rate of artificial green space
	Water system diversity	Various habitats	Species diversity of animals and plants	Habitats preservation, Plantation plan for tempting wild animals
		Various water space	Various water space	Securing water space area
	Energy source diversity	Security of water resources	Various water resources	Securing various water resources
		Use of alternative energy	Use of alternative(nature) energy	Energy supply facilities, Plan to use natural energy

of ecological features are assessed comprehensively. The LEED 2.2(NC) assessed mainly on the buildings therefore the outdoor space assessment is simply done on the water efficient landscaping, light pollution reduction, storm water design, and heat island effect. The outdoor spaces is assessed separately in CASBEE(New construction), and seek much more attention to the living environmental issues such as preservation and creation of biotope, townscape and landscape, local characteristics and outdoor amenity, noise, vibration and odour, and air pollution.

3.2 National research trend

The initiative phase of the research was dominated by the design factors and assessment methods for the environmentally friendly housing complexes. The research on the design factors of environmentally friendly housing complexes are Han et al. [1], Lee et al. [2] etc, and there are assessment method researches such as Jung [3], Oh et al., [4] etc. Recently, there are more researches related to the planning criteria such as Shin et al. [5], Kim et al. [6]. However, most researches are mainly concentrating in areas of the eco-friendly public housing complexes in general. The outdoor space related assessments are only limited due to the application of existing Green Building

Certification policy (i.e. land use, transportation, ecological environment).

4. ELEMENTS OF THE ASSESSMENT STANDARDS OF ECOLOGICAL OUTDOOR SPACE OF HOUSING COMPLEXES

4.1 Procedure of setting elements of the assessment standards of ecological outdoor space of housing complexes

The assessment standards from in and outside of the country and related studies and researches had been evaluated for the best development for the elements of the assessment standards of Ecological outdoor space of housing complexes. Based on these, 41 assessment indicators had been selected in the process of debates and discussions of expertise.

4.2 Goals of the 4 principals of ecosystem assessment indicator and elements of the assessment standards

The goals of the assessment indicator are established on the basic items of the developments of the assessment standard. The 4 principals of Circulation (see table 2), Stability (see table 3), Independence (see table 4), Diversity (see table 5) are displayed below.

Table II: Elements of the assessment standards for Circulation

Indicators	Assessment Goal	Elements of Standard
Water permeability pavement area	Conservation of water circulation by securing maximum area for rainwater absorption	Water permeability pavement area, Biotope-area-factor
Creation of water storage	Decreasing rain drainage by natural absorption or water storage before it goes to the water reservation area or sewage	Water reservation area ratio
Capacity of water penetration facilities	Maintenance of ecological soil environment by cultivating subterranean water from absorbed rainwater	Capacity of water penetration facilities
Gray water reusing facilities	Installation of water saving facilities which purifying used tap water to attain gray water	Installation of gray water using facilities, gray water quality standards
Drain-water heat reusing facilities	Using emitted heat to air conditioning and heating for reusing emitted energy from daily living	Heating pump system for drain-water heat reusing
Waste incinerating heat using	Using emitted heat from waste incineration for heating and boiling	Waste incinerating heat using facilities

Separate garbage collecting facilities	Recycling promotion by efficient and comfortable separate collection of recycling waste	Separate list of recycling waste collection, Number of Separate garbage collecting facilities
Composter installation	Recycling food waste from residents by installation of composter	Separate collection of food waste, installation of composter
Construction waste reusing ratio	Recycling of construction waste	Plan to recycling and reusing of construction waste

Table III: Elements of the assessment standards for Stability

Indicators	Assessment Goal	Elements of Standard
Area of natural water purification	Securing clean water by natural purifying for rainwater use	Facilities/space for natural water purification
Treatment facility for nonpoint source	Installation of non-point source pollution treatment facility for preserving water quality of subterranean water and near water course	Installation of non-point source pollution treatment facility
Capacity of natural sewage purification	Securing stable water quality by treating waste water eco-friendly in the residential complex	Capacity of natural sewage purification
Capacity of water reservation area	Counter plan for flooding with local condition	Counter plan for capacity of water reservation area
Preservation and reuse of existed surface soil	Cultivation of rich-top soil, and reusing it for increasing plantation environment	Plan to reuse existed surface soil, Surface soil reusing ratio
Use of natural topography and existing hill areas	Maximum use of existed topography and hills for preservation of local landscape characteristics	Topography changing ratio, Design for using topography
Creation area of aquatic/land biotope	Offering stable living environment by making habitat; aquatic and land biotope	Biotope area, Biotope design, Connection between aquatic and land biotope
Choice of suitable species of trees by space's purpose	Making healthy living environment by considering environmental condition like climate and soil and choosing proper species for use	Plantation plan considering space use
Plan to connect complex's inner green area with external green area	Recovery of stability of eco system by connecting inner green area and biotope with outer green area and habitat	Plan to connect inner green area with outer green area
Site plan considered wind way	Improvement of decreasing CO ₂ density in atmosphere and relieving heat island effect through site plan and landscape design which considered wind tunnel	Local climate analysis and prediction of atmosphere circulation , Wind tunnel design by simulation
Planting area connected to parking facilities	Purifying auto exhaust in residential complex and securing air quality by green area design connected to parking facility	Green area connected to parking facility, Planting plan which are suitable species of trees
Green buffer zone	Stabilizing sound environment by installation of buffer green area and ecological soundproofing walls for counter plan for noise pollution	Installation of buffer green area and ecological soundproofing walls for counter plan for noise pollution
Plot planning considering noise point	Stabilizing sound environment by sound absorption plan(sound proofing plantation) around noise making facility in residential complex	Sound proofing plantation around noise making facility in residential complex
Heat load considered planting	Relieving heat island effect by heat load considered planting which is blocking absorption of radiant heat from artificial structure and isolating reflected heat	Planting which is blocking absorption of radiant heat from artificial structure
Rate of green and water spaces	Decreasing temperature of atmosphere by evapotranspiration and blocking radiant heat by plantation and aquatic area	Area ratio which is covered with plantation, Aquatic area and green area on artificial ground

Table IV: Elements of the assessment standards for Independence

Indicators	Assessment Goal	Elements of Standard
Rainwater use ratio	Increasing independence of residential complex on water by reusing rainwater for living and gardening	Rainwater harvesting and reusing facilities, Rainwater use ratio for public water use
Gray water use ratio	Increasing independence of residential complex on water by recycling living waste water and using gray water	Gray water use ratio by gray water recycling facilities
Capacity of solar power generation	Reduction of dependence on fossil fuel by replacing a certain portion of electricity usage with Photovoltaic power generation	Portion of electricity usage with photovoltaic power generation
Heating with solar collector	Increasing energy independence by solar system equipped outer facilities which are for hot water boiling and heating	Installation boiling and heating facilities with solar collector
Use of Wind turbine generation	Replacing a certain portion of electricity usage like outer lightening with wind power generation system	Installation of wind power generation system
Using geothermy for air-conditioning and heating	Reduction of energy use by using geothermy for heating and air conditioning public facilities	Installation of system which is using geothermy for air-conditioning and heating
Vegetable garden and fruit trees area	Self-supplying some portion of food resources by planting fruit trees in green area and making small cultivation area in residential complex	Making vegetable garden and fruit trees area
Recycling facility plan	Revitalization of recycling and reusing by establishment of self-reprocessing for certain recycling materials	Facilities for revitalization of recycling and reusing by establishment of self-reprocessing

Table V: Elements of the assessment standards for Diversity

Indicators	Assessment Goal	Elements of Standard
Rate of existing green area preservation	Conservation of eco system by preserving existed plants, animals, and soil	Rate of existing green area preservation
Right density to planting	Plantation density plan which considered proper planting distance for the growth process	Proper density for planting considered proper trees
Rate of artificial green space	Artificial afforestation on paved structure in residential complex for increasing amenity of landscape and reduction of heat island effect	Rate of artificial green space, Design of artificial green space
Habitats preservation	Maintaining ecological continuance before and after development by preserving existed habitat of living things on site	Plan for preserving existed habitat of living things on site
Plantation plan for tempting wild animals	Plantation plan for tempting insects and wild animals which are harmless to the residential environment for various ecological environment	Plantation plan for tempting insects and animals
Secure of water space area	Securing aquatic area for inducing various aquatic space plan in landscape design	Making various aquatic area by considered existing water resources
Secure of various water resources	Securing multiple water resources on site for reducing the usage of water supply	Various water resources and to secure water quality
Energy supply facilities	Energy facility plan for replacing fossil fuel use which is for electricity, heating and air conditioning	Use of alternative energy (solar power, hydrogen energy, steam supply, power generation, and etc.)
Plan to use natural energy	Use of diverse natural energy (wind force, waste heat, geothermic, water heat, waterpower, biomass etc.)	Use of natural energy (wind force, geothermic, biomass, and etc.)

5. CONCLUSION

Therefore this research had clearly displayed the elements of the assessment standards by selecting the assessment indicators for the ecological outdoor space of housing complexes valuation. The ecological outdoor space for housing complexes assessment indicators consist of 14 main issues regarding the 4 principals of ecosystem, and based on these, 21 assessment items and 33 assessment categories were established. In addition, the research adopted the international green building certificate policy standards and previous experiments results to fit into the aim of the process of selecting the assessment indicators for the planning of ecological outdoor space of housing complexes.

This study demonstrates that the new ecological fundamentals applied to the outdoor space of housing complexes.

The assessment indicators in this research requires to be verified and examined further by the expertise and as well as residents' opinion. Further on, individual indicators have to be more researched in detail and weight system need to be established. Nevertheless, the constant research and surveys on real housing complexes is needed in order to apply these theories in reality.

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