THE CHECKLIST FOR ENVIRONMENTAL-FRIENDLY CONSTRUCTION PROJECT MANAGEMENT IN CONSTRUCTION PHASE

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ABSTRACT: Construction project is necessary element for human life to upgrade the quality and convenience. However, due to its contradictory nature to the environment conservation, environmental pollution and damage, deterioration of natural scenery, noise/vibration, water quality pollution, etc. caused in the process of construction greatly affect the environment. The purpose of this study is to propose checklist for environment management can be used in construction phase. For this, we went ahead with the research by studying the existing research related to environment-friendly construction project management both at home and abroad, investigation and analysis of environment-related laws and ordinances, and drawing the checklists for natural environment and living environment at the construction phase. As a result, we were able to compile a checklist for nine items including geological features, animals and plants, use of soil, quality of air, water, and soil, construction wastes, noise, vibration, recreation, and sceneries. The checklist is structured in 4 grades and coded so as to allow it to be developed with the use of computer system in future. We hope that the checklist presented in this study will help lead the managers at the construction phase in construction development sustainable from the perspective of environmental conservation.

Keywords: Checklist, Environmental-friendly, Construction management

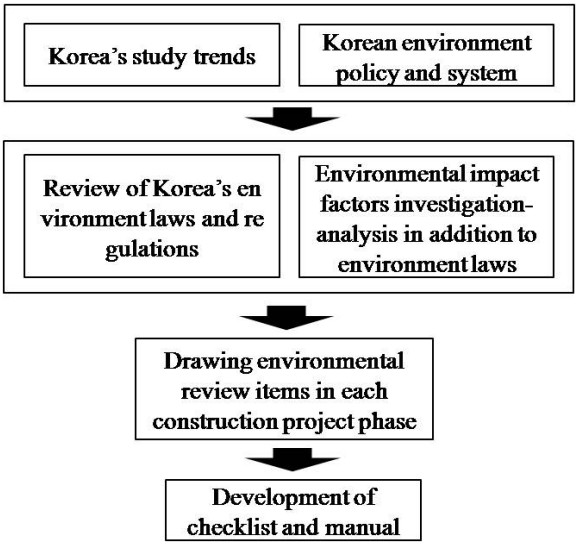
1. INTRODUCTION

In the process of construction, its impacts on environment including earth and earth surface pollution, water quality pollution, construction waste, noise, vibration, dust, ecosystem damage, and natural landscape damage are huge. A prior environmental review system and an environmental impact assessment system are implemented, based on the perception of environmental importance, in an effort to prevent negative environmental impacts, deriving from construction projects. However, those systems are not enough to be used in actual construction sites, due to the evaluation items are not sophisticated. Currently, various studies to minimize or reduce environmental pollution caused in the construction phase are conducted with the perception of environment management importance. This study aims at presenting the checklist and manual in each environmental area in the construction phase in establishing and implementing construction projects.

This study has been conducted in the following procedure and method:
(1) Investigation and analysis of the existing literature on construction environment management.
(2) Inquiry into prior environmental review and environmental impact assessment.
(3) Drawing environmental review items to be considered in construction projects by compiling and analyzing environment-related laws and regulations.
(4) Presentation of checklist for environmental –friendly management in the construction phase.

Figure 1 shows the flow chart of this study

Figure 1. Study Flow Chart



In the design phase among the construction project implementation phases, the specific direction of construction is mostly decided, and environmental impacts can be forecast and reflected. However, the construction phase affects the environment most in terms of water quality pollution, construction waste, and noise and vibration. Moreover, it is difficult to present environmental-friendly checklist and manual that can be applied to all construction projects, because the scope of construction projects and facilities are extensive. This paper limits to natural environmental area and living environmental area among the generally used areas in the prior environment review and environmental impact assessment in the construction phase. And, 9 items in the 2 abovementioned areas have been set by reflecting experts' opinions. Table 1 demonstrates environmental review items in the 2 areas.

Table 1. Environmental Review Items

Area	Item
Natural Environment	Geological features, animals and plants (2 items)
Living Environment	Use of soil, air quality, water quality, earth, waste, noise and vibration, recreation and sceneries (7 items)

2. LITERATURE STUDY ON THE ENVIRONMENTAL MANAGEMENT IN THE CONSTRUCTION INDUSTRY

2.1 Korea's Study Trends

Na, Duk-Su (2004) drew environmental management review items to be intensively managed, and presented checklist, focusing on the Air Preservation Act in the "Development of Air-Environment Management Guideline in Building Construction Process."

Park, Hyun-Su (2007) presented review items by each environmental area for efficient environmental management by categorizing the phases of housing lots development as location phase, basic development and implementation design phase, construction phase, and maintenance & management phase, in case of implementing a housing lots development project in the "A Study on the Environmental Review for Environment-friendly Residential Land Development Project."

Yoon, Ho-Bin (2008) presented environmental review items in the natural ecosystem environmental area by classifying construction project management as master plan stage, basic planning and implementation design stage, and construction and maintenance stage in "Environment Review Factors for Environment-friendly Construction Management in the Natural and Ecological Environment Sector."

Jung, In-Su (2008) selected environmental assessment factors to be considered in the initial location phase through an analysis of the review opinions of a prior environmental review and an environmental impact assessment in "Environmental Evaluation Factors for Site Designation of Residential Land Development Project in Korea."

2.2 Korea's Environment Policy and System

The Ministry of Land, Transport and Maritime Affairs (MLTM) has prepared mid and long-term framework program for construction environment plan as a detailed implementation strategy, and has continually implemented the program by establishing fiver-year construction environment framework programs. The mid and long-term framework program for construction environmental policy formulates and presents the foundation and characteristics of the program, 3 major objectives, 10 top implementation tasks and the plans for detailed strategies, implementation, and management. The Ministry of Environment revised the Framework Act on Environmental Policy in May 2005, and amended the Environment Decree of the Framework Act on Environmental Policy in May 2006, and thus innovatively improved the prior environmental review system, and developed the environmental assessment system that introduced a strategic environmental assessment system. Table 2 exhibits the review items defined in the prior environmental review and environmental impact assessment as 23 items in 3 areas (natural environment, living environment, social and economic environment).

Table 2. Environmental Review Items in the Prior Environmental Review and Environmental Impact Assessment

Areas	Items
Natural Environment	Weather, geological features, animals and plants, marine environment, irrigation and floodgate
Living Environment	Use of soil, air quality, water quality, earth, waste, noise and vibration, recreation and sceneries, foul odor, electric wave disturbance, sun lighting hindrance, sanitation and health
Social· Economic Environment	Population, residence, industry, public facilities, education, cultural assets

3. DRAWING ENVIRONENTAL REVIEW ITEMS IN EACH CONSTRUCTION PROJECT PHASE

The environmental laws and regulations consist of individual laws and regulations and related supplementary laws in various areas, based on the Framework Act on Environmental Policy to embody the environmental rights under the Constitution. These laws and regulations can be classified as environmental laws and regulations aiming at direct environmental conservation, and environment-related laws and regulations indirectly related to environmental conservation. The former sets for the matters that have to be handled, such as environmental conservation

objectives, assessment criteria of environmental impacts, and pollution reduction measures. The latter refers to the laws and regulations providing some rules for environment conservation or specifying criteria for environmental impact assessment, though their purpose is not for environmental conservation. This study has drawn ultimate environmental review items, based on the open interview results, after the open interview with experts having at least 5 years of construction and environment project experiences so as to review the appropriateness of matters to consideration in the natural and living environmental areas.

4. CHECKLIST AND MANUAL

4.1 Checklist

The checklist should include small scale development projects, as well as the projects for environmental impact assessment, so as to be commonly applied and used in all construction projects. The checklist needs to present environmental review items suitable for each construction project phase, and be easily accessible to environmental management that users should perceive. Also, the checklist needs to be excellent in conversion possibility (code type) as the manual form of instructions, in compatibility, and linkage with system development.

(1) Natural Environmental Area

In this study, two assessment items –geological features and animals and plants in the natural environmental area – have been developed. Table 3 shows the checklist in the natural environmental area in the construction phase.

Table 3. Checklist in the Natural Environmental Area

Construction Project Phase	Assessment Item	Checklist	Code
Construction Phase	Geological Features	Measure to handle fertile soil	C010101
		Measure to prevent earthy materials outflow	C010102
		Measure for slope stabilization	C010103
		Measure for weak foundation	C010104
		Measure to reduce earth, when it moves.	C010105
	Animals and Plants	Measure to preserve major creature population	C010201
		Replacement and new development of biotope	C010202
		Measure to preserve blue-green network	C010203
		Measure to reduce river disturbance by earthy materials and physical impacts	C010204
		Environmental-friendly measure to reduce impacts on water sides and slopes	C010205

(2) Living Environmental Area

This study has developed the checklist for 7 assessment items: use of soil, air quality, water quality, earth, waste, noise and vibration, recreation and sceneries. Table 4 shows the checklist in the living environmental area in the construction phase.

Table 4. Checklist in the Living Environmental Area

Construction Project Phase	Assessment Item	Checklist	Code
Construction phase	Use of soil	Minimization of impermeable area	C020101
	Air quality	Status of regulation on the construction vehicles (related to dust scattering control)	C020201
		Measure to control dust scattering in case of construction	C020202
	Water quality	Measure to prevent underground water pollution	C020301
		Measure to manage earthy materials	C020302
		Measure to treat waste water generated in case of construction	C020303
	Earth	Measure to prevent earth pollution in case of construction	C020401
	Waste	Measure to treat construction waste	C020501
		Status of meeting waste treatment criteria	C020502
		Measure to treat forest trees waste generated by construction	C020503
		Measure to treat specified waste generated in case of construction	C020504
	Noise· Vibration	Measure to reduce noise and vibration	C020601
	Recreation· Sceneries	Ecological restoration method (ecological restoration and afforestation)	C020701

4.2 Manual

In this study, the manual has been drawn up through an analysis of literature including environmental impact factors, related laws and regulations, cases that need to be considered in each construction project phase concerning 9 items in the natural and living environment areas. The manual has been presented in the common instructions form taking various types of construction project features and scales into account. The manual has been coded to consolidate the feasibility of checklist and system development, and accessibility at the user level. This is to intensify efficiency from the managerial perspective to immediately respond to environmental index development, related content change, and legal revisions that consider contemporary situations. Table 5 shows the manual composition and contents.

Table 5. Manual Composition and Content

Composition	Details
Definition of Terminology	Enhance understanding and utilization of related contents by easily explaining jargons, which can be somewhat difficult to business people and general people.
Relevant laws and regulations	Reflect basic matters that should be complied with during actual project period by specifying the review items of checklist, related laws, enforcement decrees, enforcement rules, notices, and instructions.
Criteria and references	Enhance understanding of detailed matters by complementarily describing the matters related to review items.
Tip	Induce users to properly understand environmentally and apply by construction project phase in case of referring to the additional information, expert advice and application direction regarding the concerned review items.

Table 6 and 7 exhibit the examples of the manual concerning geological features in the natural environmental area, and air quality in the living environmental area.

Table 6. Manual Example of Geological Features Items

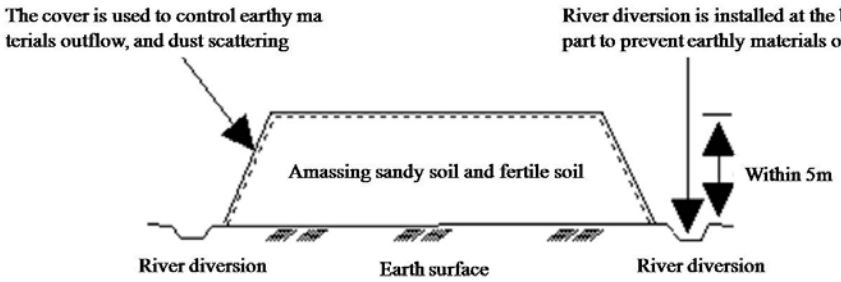
<table>
<tr><th>Code</th><th>Composition</th><th>Details</th></tr>
<tr><td rowspan="4">C010101</td><td>Definition of Terminology</td><td>Dynamic Compaction Method: A method to acquire a compaction effect by repeatedly dropping a heavy object on the weak foundation to be improved. That is, this is the method to harden foundation down to great depth …
(Omitted)</td></tr>
<tr><td>Related Laws and Regulations</td><td>Definition of Article 2 of the Natural Environment Conservation Act:
5. Ecosystem refers to the material system or function system, in which living creatures in a certain region, and inorganic environment that maintain those creatures, are combined.
(Omitted)</td></tr>
<tr><td>Criteria and References</td><td>Measure to treat fertile soil (example)
<table>
<tr><th>Category</th><th colspan="2">Region</th></tr>
<tr><td>Generation of fertile soil</td><td colspan="2">Forest land</td></tr>
<tr><td>Fertile soil control plan</td><td>Utilization plan</td><td>Landscape architectural planting, slope afforestation, reuse of earthy materials</td></tr>
<tr><td colspan="3"> 
</td></tr>
</table>
(Omitted)</td></tr>
<tr><td>Tip</td><td>A constructor should consider the measure to handle fertile soil by referring to the Construction Environment Management Standard Specifications of MLTM. For fertile soil handling, review the measures to preserve fertile soil in the temporary amassing area, install river diversion, side vent and dust cover around the temporary amassing area, set up vinyl cover and use green area (slope planting) in case of long-term preservation.</td></tr>
</table>

Table 7. Manual Example of Air Quality Items

<table>
<tr><th>Code</th><th>Composition</th><th>Details</th></tr>
<tr><td rowspan="3">C020201</td><td>Definition of Terminology</td><td>Object in powder state: Materials that can cause as much dust as caused by earthy materials, coal, and cement.</td></tr>
<tr><td>Related Laws and Regulations</td><td>Definition of Article 2 of the Atmospheric Environment Conservation Act:
11. A vehicle refers to the vehicle set forth in Article 2.1 of the Automobile Management Act, and those specified by the Environment Ministry Ordinance among the construction machines specified in Article 2.1 of the Construction Machine Management Act.
(Omitted)</td></tr>
<tr><td>Criteria and References</td><td>Attached table 16 of the Enforcement Rules of the Atmospheric Environment Conservation Act. Criteria of the Installation to Control Dust Scattering and Necessary Measures
<table>
<tr><th>Discharge Process</th><th>Criteria of Facility Installation and Measures</th></tr>
<tr><td>1. Open air storage (Limited to open air storage of materials in powder state)</td><td>A. Cover with dust cover, when storing the materials for open storage for one day or more.
B. Install the dust wall with height of 1/3 or higher than the highest storage height of the materials for open air storage, and the dust net with height of 1.2 fold higher than the highest storage height. Install dust wall with height of 1.8m or higher on the boundary of the construction site, engineering work site, landscaping site, and construction demolishing site (if residence/mall is located within 50m from the construction site boundary, 3m or higher of dust wall). However, when two or more of construction sites are adjoined, the dust wall may not be installed on the common boundary.
C. For controlling of dust scattering, due to materials stored in open space, install the facility to spray water (excluding the open air storage of scrap iron and water-soluble materials).
D. In case of installation of the facilities or taking an action with the equivalent effect or higher than those in A, B, and C, the installation or taking an action corresponding to A, B, and C are excluded.</td></tr>
<tr><td>(Omitted)</td><td>(Omitted)</td></tr>
</table></td></tr>
<tr><td>Tip</td><td>The vehicle set forth in the Atmospheric Environment Preservation Act means the vehicle set forth in Article 2.1 of the Automobile Management Act, and those specified by the Environment Ministry Ordinance among the construction machines specified in Article 2.1 of the Construction Machine Management Act. A business entity should consider the measure to control dust scattering that may be caused by construction and related vehicles.</td></tr>
</table>

5. CONCLUSION

Construction projects enormously affect the environment, including environmental pollution and damage, noise, vibration, water quality pollution in the construction process. This study has presented the checklist and manual for efficient environmental management in carrying out a construction project in the construction phase. To this end, this study has theoretically examined construction project management, analyzed the assessment items applied to prior environmental review and environmental impact assessment, and complied and analyzed environment laws and regulations. The major findings in this study are as follows: In this paper, the checklist regarding 2 assessment items (geological features, and animals and plants) in the natural environmental area, and 7 assessment items (use of soil, air quality, water quality, waste, earth, noise & vibration, and recreation & sceneries) in the living environmental area in the construction phase, and the relevant manual have been presented. We hope that the checklist presented in this study benefit decision makers, designers, and construction project managers in terms of sustainable development from the environmental perspective. The checklist in this study needs to be studied furthermore on the assessment items in addition to 9 items, and on the objective validation of their pertinence by applying them to actual cases so as to enhance their practical utilization.

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