

# GBT for BIM-based Green Building Certification System

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## ABSTRACT

In order to meet the threshold under the scheme, a building's environmentally-friendly should be taken in to consideration from the very initial building designing stage. However, it is true that constructors face overload and complexity in examining a lot of detailed requirements and applying them into practice effectively.

In this sense, a new method of applying requirement details is necessary to guide details and stimulate green building construction based on GBCC.

From this perspective, this research seeks to present some suggestions to practically assist green building designing based on GBT, BIM-based green template. Through GBT, the researchers aimed to support designers with rapid response system to GBCC requirements.

**KEYWORDS:** GBT(Green BIM Template), GBCC(Green Building Certification Criteria), Sustainable

## 1. INTRODUCTION

On October 20, 2012, South Korea successfully invited Green Climate Fund (GCF) - called as the World Bank in the environmental area. The GCF's secretariat office was decided to come to Songdo, Incheon, South Korea in the 2nd directorate vote during the Songdo Convensia on October 20. The GCF in Songdo has made daily headlines. Major issues of these days have been changed rapidly and increasingly filled with environmental problems. Countries over the world have established environment protection laws and green-house gas emission reduction policies under the government leadership. In the construction sector, greenhouse gas cut was targeted at 26.0% out of the national reduction goal of 30% by 2020. Against this background, efficient efforts are required to meet the goal. Many countries have implemented environment-friendly building certification schemes reflecting their own standards to encourage more construction of green buildings. The US has run LEED (Leadership in Energy and Environmental Design); UK, BREEAM (BRE Environmental Assessment Method); Japan, CASBEE (Comprehensive Assessment System for Built Environment Efficiency), and South

Korea has GBCC (Green Building Certification Criteria) currently under operation. Korea scheme checks 7 large groups according to building purposes and 38 further requirements for certification. It has 4 grades of certification under primary certification and preliminary certification.

In order to meet the threshold under the scheme, a building's environmentally-friendly should be taken in to consideration from the very initial building designing stage. However, it is true that constructors face overload and complexity in examining a lot of detailed requirements and applying them into practice effectively.

In this sense, a new method of applying requirement details is necessary to guide details and stimulate green building construction based on GBCC.

From this perspective, this research seeks to present some suggestions to practically assist green building designing based on GBT, BIM-based green template. Through GBT, the researchers aimed to support designers with rapid response system to GBCC requirements.

## 2. THEORETICAL EXAMINATION

### 2.1 Idea of BIM-based Green Building

Since the construction industry includes many negative factors for ecological environment and human health, green building has increasingly gathered more attention. Green building (sometimes called as green buildings, high-performance buildings or environment-friendly buildings) shows a way forward for the construction sector to achieve its goal of sustainability. Green buildings, also, minimize environmental burden arising from building designing, construction and maintenance while focusing on how to maximize social and economic benefits.

Green building becomes possible through comprehensive management of construction processes. From building design, construction, maintenance and removal, throughout the whole processes should be directed in consideration of environmentally-friendly to build a green structure. And these processes can be supported by BIM. BIM means to generate and use digital information regarding architectural projects and by connecting BIM with diverse analytical software, building performance test can become easier and more effective. Sustainable construction designing and environment-friendly architectural ways are advised.

### 2.2 Idea of BIM-based template

Template, from a theoretical view, is a consistent input format where certain frequently used patterns are set in advance to gain appropriate results for a specific purpose. Users can gain results they wanted efficiently by using data provided in advance.

To apply the template technique to BIM-based architecture, template functions should be identified in line with the purpose of using BIM and frequently used work repetitions should be structured for easy re-use. Presently, the absence of standardized building data and consistent BIM modeling method - two big difficulties for BIM-based architecture - can be addressed by setting necessary information in advance via template to form building components and parameters in an organized way.

### 3. GBT PROTOTYPE DEVELOPMENT

#### 3.1 Idea of GBT

GBT is an acronym of Green BIM Template. GBT includes a guide platform (GBT<sup>ⓐ</sup>) for environment analysis modeling (energy performance, CO<sub>2</sub> production) and a platform (GBT<sup>ⓑ</sup>) connected to GBCC. Its purpose is the support GBCC of Korea. Therefore, GBT is a template to connect the GBCC system automatically via BIM data and obtain appropriate results.

#### 3.2 GBT Structure

To fulfill its role of obtaining GBCC results, GBT can be structured by two divided parts: one for guide which is capable of modeling and system analysis and the other for system connection.

GBT<sup>ⓐ</sup>, guide platform for modeling, is in main frame and free set. The main frame is where modeling is actually processed through free set defined by library. This can selectively check and modify the format of work a user wants through a separate view template. Free set comprises of library setting values and arrangement elements to which environmental analytical data are added. Free set is identified according to Autodesk Revit<sup>®</sup>'s visibility information. Design information is data directly related to system environment. It is setting values of GBT<sup>ⓑ</sup>, a platform connected to GBT system. Algorithm is analyzed by the methodologies to obtain GBCC results and this, again, is set by Rule-set.

#### 3.3 GBT Process

GBT is a system template which can provide a modeling guide for the purposes of BIM-based environmentally-friendliness evaluation and work compatibly with BIM-based certification systems. GBT plays a role to build a process to reach the BIM template-based certification system results. Figure 1 shows the processes of applying GBT to environment-friendly building certification system.

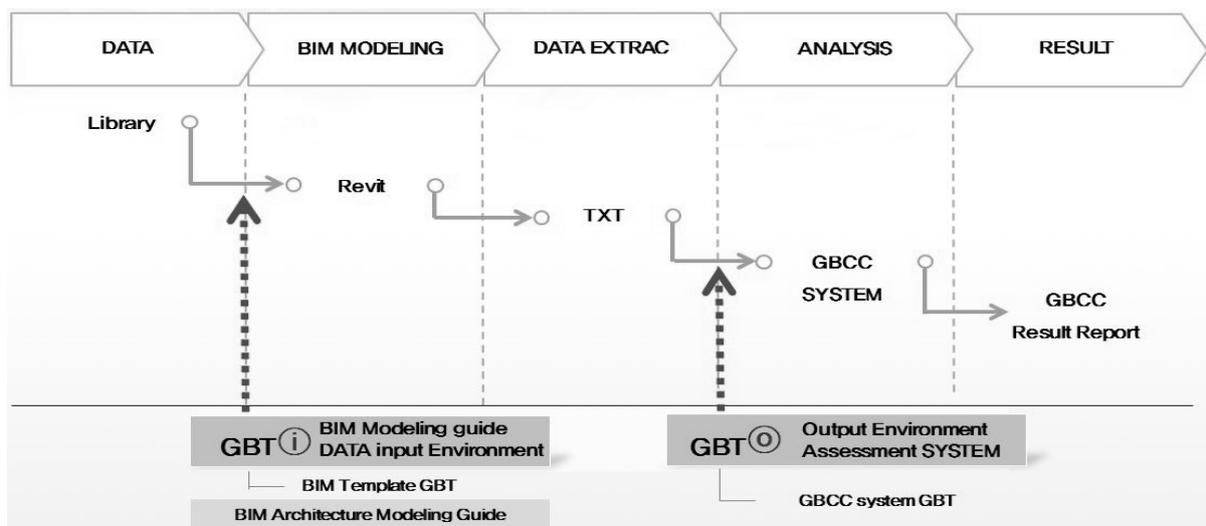


Figure 1. GBT Process

## 4. HOW TO APPLY BIM TO GBT-USING GBCC

### 4.1 About BIM-based green building certification

To check the feasibility of applying BIM to green building certification scheme, detailed certification criteria need to be further identified based on BIM data. BIM data produces objective information and nature information of a building structure. For the purpose of this study, the researchers needed several more additional data according to site plan to address apartment housing of green building certification. So this study separated data based on BIM data generation methods.

It also had to be checked if BIM data were possibly extracted and applied in line with certification sub-criteria. Therefore we examined if BIM modeling could include data satisfying each criterion in nature information or object information to be extracted in TXT file format. The data extracted by this examination became database and used as input data by system algorithm.

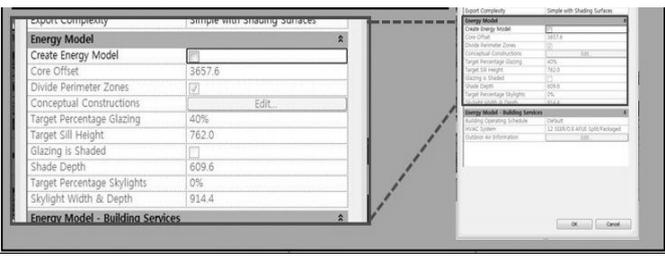
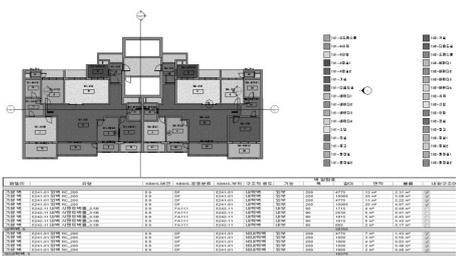
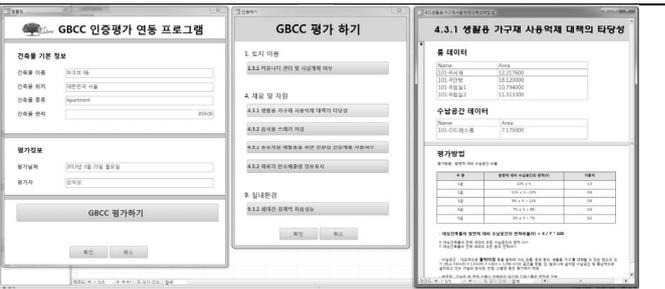
If the data are extracted in TXT file and form database, we can extract only the kind of data that can be assessed by GBT<sup>Ⓢ</sup> system and check the results. Here, we employed additional method of user input along with the checklist for GBT<sup>Ⓢ</sup> system development algorithm so that designers or evaluator could also exercise their view on evaluation.

### 4.2 Applicability of BIM to GBCC

The base here is a floor with 2 units of an apartment house.

The modeling data gained through library with GBCC-requiring nature data input underwent district-specific zoning and were changed to TXT file through list table.

Table 1. Applicability of BIM to GBCC

DATA	BIM Modeling
	
ANALYSIS	RESULT
	

Necessary data were extracted from the modeling data via list table. Here, view template pre-set by GBT<sup>①</sup> was used to check and any modeling not satisfying the threshold was corrected. The data in TXT file are used as evaluation data by GBT<sup>②</sup>. GBT<sup>②</sup> can check evaluation result grade of each sub-criteria if project outline is handed over from an ordinary form to GBCC evaluation stage. The developed GBT in this thesis was applied to GBCC as shown in Table 1.

## 5. CONCLUSION

As awareness on the necessity of green building has been expanded recently, South Korea has launched green building certification criteria (GBCC) and certified many building structures. However, some of the building architectural criteria corresponding to GBCC requirements are not very objective with qualitative nature and may be too much detailed to gain clear understanding or a holistic view. Responding to this, the research sought to develop a user interface using BIM-based GBT for easier evaluation. As a result, the study findings are as follows:

To this end, first, after scrutinizing Korea's green building certification system, we needed a more systemized platform that could help us reach a modeling guide equivalent to the certification scheme and decent outcomes. So, for the purpose of this study, we developed GBT<sup>①</sup> for guide and better organized GBT<sup>②</sup>.

Second, GBT<sup>①</sup> supported necessary data since data equivalent to GBCC requirements were not operable in the existing BIM environment.

Third, data modeled by GBT<sup>①</sup> were graded for GBCC sub-criteria by GBT<sup>②</sup>.

For future studies, the researchers plan to develop additional approach to better systemize the qualitative aspects of GBCC requirements to enable comprehensive evaluation and real-time feedback of data equivalent to the requirements so that green building becomes far easier.

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