A Study on the Application Method of Civil BIM through Cases and Policy Analysis

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Abstract: Recently as conducted in the field of construction, utilization of BIM (Building Information Modeling) is becoming a hot issue as a new alternative in construction industry. In architectural project, the research to expand BIM is being actively conducted. However, unlike architectural project, civil project has non-repetitive and non-programmed work process and the range of performing the project is so wide that the establishment of BIM is not that effective. Therefore, this study provides the application methods of civil BIM effectively via international standard activities and policies analysis which has been developed based on architecture. The application of BIM to civil project should be the innovation intentionally planned by the efforts and commitment of public and private institutes which will lead to the support at the national level.

Keywords: BIM, Civil Project, Application Method

1. Introduction

Recently, the application of BIM (Building Information Modeling) has been actively reviewed and widely used as one of the strategic methods for managing design and construction of large complex facilities including skyscraper, non-programmed and eco-friendly buildings in AEC field (Architect/Civil

Engineering/Construction) all over the world (Choi, 2009). In addition, for the development of construction industry planning, operation and maintenance has become an important consideration for work management.

This approach has been considered as an important component to better manage the design information.

Developed nations including United States, Europe and BIM was introduce through constant efforts and as a result, they have rapidly improved their industrial competitiveness by innovating the manufacturing system in construction industry, reorganizing the industrial structure and integrating the processor of the life cycle of the building before construction.

However, BIM technology in civil project has not been extended comparing to architectural project due to lack of development and interest. Especially, for

building 3-D modes of road and bridge construction a lot of trial has been made. Results for the 3D model structures were mostly for 3D simulations for landscape viewing. So, it is hard to find any cases where BIM is applied to each steps in the construction project leading to quality improvement and construction support.

Therefore, in this study we propose a method which we can effectively introduce BIM in civil engineering base on the international standard activities and policy cases which have been reviewed.

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2. Definition of BIM and International Standard Status

2.1 Definition of BIM

BIM (Building Information Modeling) is the integrated system to make stepwise information generated from each work process concrete and manage them.

BIM specifies and explains the object of the construction and the information meaning. It also

means the status of the system established to operate and to manage all the information in construction processor with interconnectedness.

Consequently, BIM is the process to expect the construction, reduce trials and errors and make high quality building via virtual simulations based on 3D modeling with data on the object.

2.2 ISO

Designing facilities using BIM technology refers to the process of modeling facilities by assembling virtual materials in virtual space (Jo et al. 2012).

User models facilities by assembling virtual materials classified as the object in virtual space via BIM. Such design information of BIM model can be used for various design steps and also for construction step by creating necessary information like construction errors, arrangement of apparatus and so on. In architectural project, international standard activities have been promoted for the effective use of BIM information in each step. Representative ISO standard related to the use of BIM information is shown in Figure-1. ISO 12006-3 establishes data schema to define each object in object-oriented information system, so it is used to establish library for making the same concept of object information compatible which can be defined differently according to regions and professional skills.

TC59/SC13 handles the processor, and ISO 16739 suggests IFC(Industry Foundation Classes) standard data model which is for the connected base between such data models. However, IFC mainly handles building structures, so it has not enough international standards for large-scale civil structures such as roads, railways, bridges, tunnels and dams.

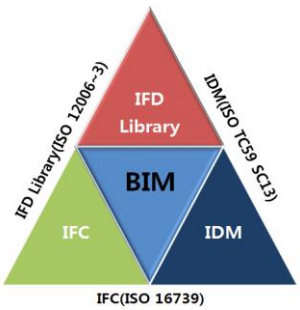

FIGURE-1. BIM Framework of ISO

3. BIM Guideline and Policy

Guideline for the application of BIM technology should be classified according to its usage. Generally, it can be classified into technology guideline, order guideline and solution development guideline.

Technology guideline is like a practical methodology for the application of BIM technology in the industry, order guideline is the criteria for the presentation of outcomes and solution development guideline is to support various processors using BIM object.

3.1 Germany (BIM/IFC User Guide)

BIM/IFC User Guide is IFC-based user guide for information exchange between various BIM S/W and facility management programs written in 2006 by German IAI. All related Tool sales companies participated in making this User Guide and this User Guide provide methods to use each tool for information exchange and guidelines for IFC change. In addition, user can see the original files of each tool and IFC files used for Guide on the homepage.

3.2 Norway IDM(Information Delivery Manual)

Norway has researched IDM to support information exchange required for life cycle of buildings. Main purpose of Each IDM is to develop a kind of data component to make smooth exchange of IFC models. IDM concept is to overcome the limit of IFC information exchange. The difference between IDM and IFC is that IFC is intended to provide all the information regarding life cycle of buildings while IDM provides information at the individual component level in each step of buildings' life cycle.

3.3 USA GSA(BIM Guide Series)

In 2003, GSA, PBS and OCA in United States created National 3D-4D-BIM, and they have conducted pilot projects on ten public buildings and presented BIM Guide Series based on the results. Also, GSA requires all the projects ordered by GSA to be designed based on BIM and to be presented in the IFC format since 2006.

3.4 USA NBIMS(National BIM Standard)

NBMIS is the proposal for BIM standardization

released by NIBS in December 2007. NBMIS is the result from standardization of BIM to provide guideline for the generation and management of information during life cycle of buildings in planning, design, and construction and maintenance steps (Table 1).

Table- 1 Nation BIM Standard(USA)

category	definition
BIM Scope	Definition of the step of the building, participants, facilities and elements.
Coverage	Management of the version
Reference Standards	Standardization of documents for compatibility with standards from other organizations and nations
Business Process	Interface on various parts of NBIMS and business process
Business Rules	Definition of the relation between the process and each process
Data Structure and Models	Core elements
Implementation Guidance	Suggest guideline, training and checklist for the application of BIM
Maturity Mode	Definition of the type and amount of information

3.5 Singapore (CORENET)

In 1995, CORENET is e-Plan Check started with the institute supervised by Ministry of National Construction and Development in Singapore. Based on the system, various rules can be applied for regulations and plan check. Currently, in Singapore, building design, space analysis, fire protection regulation can be checked by using IFC BIM files. Almost all persons concerned in Singapore is now using this system, and about 2,500 companies related to construction, real estate and engineering are using this system.

3.6 Policy Trends of BIM

With examining policies of advanced nations in BIM field, Finland has required to deliver an open-type BIM standard in real estate management field under the government since 2007 and Denmark has also required public works over 5.3 million EUR per month to present open-type BIM data.

Norway requires to present energy analysis data by BIM when licensing buildings and to use IFC and GIS for the plan evaluation in construction field and it has plans to use BIM from planning to approval of use. Germany is now establishing IFC-based new procurement standard using the previous procurement standard. China sets BIM as the standard for design cooperation and will select IFC format as the construction standard.

Hong Kong creates an order of construction according to the type of process such as airport, road, housing and transportation. For the application of BIM, concerned department of Hong Kong prepares and applies the criteria for each process. Also, some departments like Hong Kong Housing Authority makes and uses the standard manual and operates the related institute, The Hong Kong institute of building information modeling to study BIM related criteria.

3.7 Implications of Architecture BIM

In construction industry, good results such as improvement of design, construction, quality and productivity and cost and construction period reduction can be found in various cases. Also, BIM-related institutes and organizations are divided into public and private institute differentiating their roles to response systematically to the application of BIM. In such cases, the successful effect of BIM application is promoted through many seminars and trainings, problem factors are minimized based on accumulated experiences, arrangement and cooperation between various professional fields are chosen and BIM training course and certification programs for professionals are offered.

Therefore, in civil project as well, the effective system should be established not merely by the application of technology but by setting clear purpose and range to show visual outcomes via the application of BIM.

4. Action Plan of Civil BIM

We have researched BIM international standard activities and cases for the application of BIM technology to civil project which has been developed

based on architectural project. For civil project where mostly orders of public construction are made, institutional foundation should be established first to apply BIM technology effectively. At the same time, professional workforce should be fostered for constant development and use of technology. This study suggests methods for individual fields to apply BIM to civil project are as follows:

First, enforcement of BIM activation policy of public institutes for civil project. The role of public institutes to contribute to BIM activation is to support BIM in the view of institution and policy, to offer the foundation for BIM activation via orders of public construction and to establish and distribute various standards and criteria.

Second, selection of effective principles in the process of institutional support. BIM is the tool for innovating the manufacturing system in construction industry, so with this, the efficiency of construction work process can be increased. Therefore, policy direction in the view of support should be considered to apply BIM because the resistance and problems may occur when introducing new method and system abandoning the previous work system.

Third, joint application of IFC, international BIM standard. As BIM is not the information circulated only in Korea but international standard has been prepared, operating construction business with BIM can lead to globalization. Therefore, the application of IFC, international ISO standard as the standard format of BIM data for orders of public construction can enhance global competitiveness of the company and improve work efficiency by sharing information between participants via BIM.

Fourth, universal use of BIM tools and fostering work force. Each participant should adjust to the concept of BIM and system & application process because BIM-based system can be different from the previous system. Especially, 3D CAD system design tool can be a significant change to hands-on workers who are familiar with 2D CAD, so training and management are important.

5. Conclusions

The BIM application cases of architectural project, it can be a chance for construction industry to leap ahead via innovation of the whole process of construction industry.

BIM application to civil project should be the innovation intentionally planned by the efforts of public and private institutes, and it need the support at the national level. Also, based on this, BIM-based pilot projects should be performed in accordance with various types of facilities and orders of public institutes to find problems and solutions when applying BIM and to supplement related standards and guidelines.

BIM is just a tool for sharing information for design, construction and maintenance. However, it is a useful tool to lead to the significant innovation in construction industry and more maximized effects can be expected through engineers operation and process changes.

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