BIM을 활용한 현장시공의 친환경 위험관리에 관한 연구

Risk Management for Environment Protection in Job Site Utilizing BIM Method

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Abstract

With the rise of green technology, the environmental question causes people's attention more and more, based on objective of the sustainable development, the green risk has already begun to appear. In the paper the definition of the green risk of construction project is given, it analyzes and identifies the green risk of construction project from three aspects, based on BIM, the relation with green risk was found. Though the relation, the management of green risk was analyzed and we may take some measures to reduce the unnecessary risk and waste.

1. Introduction

1.1 Background

The green building movement has profound implications for owners, design professionals and contractors. Although much has been written about the growing momentum of green development and the increasing application of green rating standards, surprisingly little has been published addressing the identification and management of risks associated with green design and construction. The risk subjects (e.g., standard of care, damages, scope of services, etc.) represent traditional areas of contractual risk. (Gibbons, 2009)

With the rise of green technology, the environmental question causes people's attention more and more, based on objective of the sustainable development, the green risk management has already begun to appear.

Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from sitting to design, construction, operation, maintenance, renovation and deconstruction. So green building is also known as a sustainable or high performance building and need aim at 3R, reducing environment pollution, reducing resource use, and reducing energy source use (U.S. Environmental Protection Agency, 2009). Therefore definition of the green risk of construction project is indeterminacy factor that affect a goal attainment of sustainable development in the construction

The green risk management has the process like the general risk management, Risk Management includes the processes concerned with identification, analysis, responses and monitoring and control on a project. The objectives are to increase the probability and impact of positive events and decrease the probability and impact of events adverse to a project." (PMBOK, 237)
According to the experience of development of construction, we have mainly the risk in the construction, environment factor, source factor, energy factor.

The building and facility industry is undergoing radical change today as owner demand more project visibility lower costs, better risk management (scheduling and costs), and increased use of these new technologies in projects.

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1.2 Research Method

BIM(building information modeling) is a relatively recent switch in design and documentation methoddology in the design and construction industries. BIM is information about the entire building and a complete set of design documents stored in an integrated database. (Krygiel,2008)

At present, most companies use BIM for 3D/4D clash detections and for planning and visualization services. The use of BIM leads to increased productivity, better engagement of project staff and reduced contingencie. and the key benefit of BIM is its accurate geometrical representation of the parts of a building in an integrated data environment..(CRC Construction Innovation,2007).

BIM based on 4D models have reduced unplanned change orders by 40% to 90%, reduced rework, increased productivity, and improved the credibility of the schedule and the project management teams.(Fischer, 2004).

BIM may provide more visibility into projects and allow owners to manage risk through a collaborative and inclusive process. The inclusion of green technologies allows stakeholders to collaborate as well in this process. (Boutwell, 2008)

2. Analyze the Green Risk of Construction Project

2.1 Identification of Green Risk

Risk identification is the process which seeks to understand the project, determine which risks are likely and document the characteristics of the risks. It is mostly concerned with opportunities and threats. Risk identification is never really completed until the project is also completed. It is a process which is undertaken throughout the life of the project. The approach one must take is to gather as much relevant data as possible and schedule a risk management meeting with the core team members. Including the core team members is the surest way to secure support for a structured and thorough approach to identifying risks.

Table 1. Green Risk of Construction Project

Green Risk		
Environment	Resource	Energy
−Mechanical exhaust −Construction noise −Water pollution −Flying dust −Unsuitable material chosen Damage natural environment −Produce construction waste	−Materials and equipment mismanagement −Unsuitable construction schemes and planning −Low technology −Materials consumption is not in detail −Affection of natural disasters −Design change −Project planning change	−Materials consumption is not in detail −Inadequate control of energy consumption −Low technology −Unsuitable construction scheme −Inadequate control of transport consumption

The most common tools and techniques used for developing a list of project risks are brainstorming, nominal grouping technique, mind mapping, Delphi technique and lessons learned from similar projects.

2.2 Analyze the Relationship between Green Risk and BIM

The objective of risk identification and classification are to analyze the green risk better. Because of difference of risk resource, the analysis method is different.

Once indentified, a plan for managing each risk can be developed using the following risk management methods: risk retention, risk transfer. Risk retention can be illustrated using the previous example in common. The contractor may decide to retain the risk of achieving the owner's required green building certification based on previous experience on similar projects and a detailed analysis of the project documents.

Risk transfer maybe transfer to other people for appearance green risk. For example, reduce high energy consuming materials, heavy pollution materials and so on.

Based on these methods, we recognized that we need a detailed analysis of project documents, the best planning and a analysis report of the lowest energy consuming materials in detailed.

Adoption of BIM in the building industry has changed the way facilities are designed, constructed, and even operated. Simply put BIM is a digital rendering of the physical and

functional characteristics of a facility. More than just the lines and arcs associated with traditional computer-assisted drawing(CAD) tools, BIM includes the "intelligent objects" of a structure, such as spatial data(3D), unstructured data(text), and structured data(databases, spreadsheets), as well as new views like scheduling and cost information(termed 4D and 5D, respectively).

BIM is not just the adoption of new technology, but also incorporates new collaborative design and planning in the beginning phases of a project. So that costs and risks in later stages like construction and operations (where most of the costs are incurred) may be managed and contained.

Through BIM model and the data came from model analysis, making the connection between management of green risk of construction project with BIM to get the benefit and reduce the energy consumption and make technology management.

3. Management based on BIM

Buildings are climate modifiers that provide indoor environments essential to the well being and the social and economic developments of mankind. However, buildings are also intensive resources consumers, requiring enormous amount of materials and energy to construct, operate and maintain.

Here through analyzing the green risk from 3 factors ,we can find some measures to management and prevent green risk.

- Energy factor: the energy model combines some factors (HVAC, lighting levels···) to predict the building's energy demands. By keeping the energy model updated with the current design, we can begin to understand how building massing, building envelop, window locations, building orientation, and other parameters affect energy demands. From the results of energy analysis, we can derive detailed informations: 1)assessment of the space and building energy performance for compliance with regulations and targets. 2)overall estimate of the energy use by space and for the building and an overall estimate of the energy cost. 3) time based simulation of the energy use of the building and time based estimate of

utility cost. 4) lifecycle estimate of the energy use and cost for the building. By the above results, Materials consumption, control of energy consumption, Construction scheme and control of transport consumption could be solved by detailed database more easily.
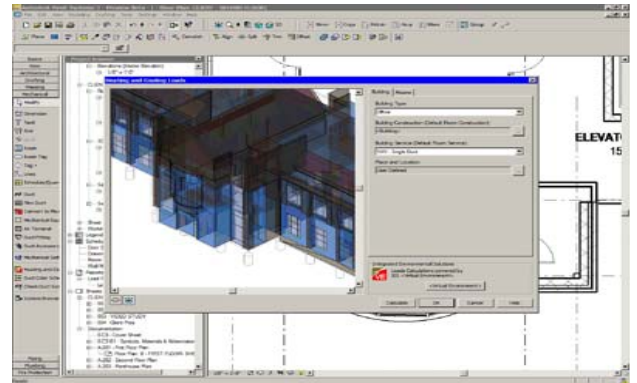

Figure 1. By using the Revit architectural design model to analysis energy

- Resource factor: based on the database from BIM model, the project team could see how their material selection, the team revised their selections to enhance regional economic benefit while also decreasing the project's embodied energy carbon footprint. Materials can be selected and analyzed by engineering in advance. Based on the analysis green risk can be prevented at utmost in the construction.

- Environment factor: in the building construction, for mechanical exhaust, construction noise, water pollution, flying dust ,nature environment damage and construction waste, we cannot indirectly prevent in advance, but though the suitable planning and scheme reach to the more effective management.
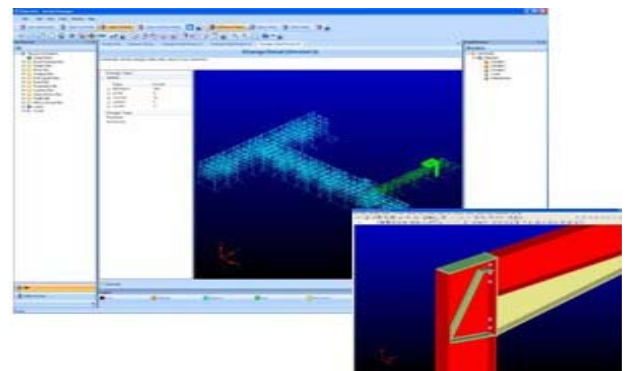

Figure 2. materials analysis

4. Conclusion

Construction project is a complex process and cycle of time is so long that demand of resource and energy consumption is large, therefore we should recognize the green risk and suitable identification, based on the BIM and green technology to prevent, change and transfer green risk. In the building construction take effective measures to reduce the unnecessary risk and waste. Accordingly construction industry will achieve sustainable development.

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BIM을 활용한 현장시공의 친환경 위험관리에 관한 연구

최근 전 세계적으로 환경문제에 대한 관심이 증가하면서 건축분야에서도 친환경을 위한 노력이 증가하고 있다. 본 논문은 BIM 모델에 근거하여 친환경 현장시공의 위험도 관리에 관한 연구를 하였다. 친환경건축은 지속가능한 발전을 위한 건축으로 3R(Reducing environment pollution, Reducing resource use and Reducing energy source use)표준에 도달해야 한다.

BIM은 3D설계, 시공, 유지관리의 효율성 극대화를 위해 건축설계를 2D에서 3D로 전환하고 수량, 공정 및 각종 분석 등의 정보를 통합적으로 활용하는 기술이다. 그리고 4D는 3D기술에 시간을 추가한 것으로써, 3D모델이나 4D모델에 기반을 두고 있으며, 원가관리, 계획관리, 설계 및 재료관리 등이 BIM 때문에 변화하고 확대하고 있다. 이를 통해 위험관리도를 분석할 수 있다.

본 논문은 먼저 세 분야(환경요소, 자원요소, 에너지요소)에서 친환경시공의 위험요소를 분석하고 판별하는 방법을 소개한다. 현장에서 일어날 수 있는 위험 확인은 이 공사를 통해서 위험을 판별하고 위험특성도를 찾을 수 있다. 다음으로 친환경위험과 BIM의 관계를 분석한다. 요즘은 BIM이 많이 활용되어서 쉽게 BIM 모델의 데이터베이스를 이끌어 낼 수 있고, 위험을 미리 예방할 수 있으며 옮길 수도 있다. 친환경위험의 세 분야는 분석을 통해서 개별적으로 위험관리를 할 수 있다. 친환경건물은 에너지분야 비율이 비교적 많은데 현장시공의 친환경도 비슷하다. 따라서 위험을 미리 예방하여 에너지를 절약할 수 있다. 소프트웨어를 통해 공간과 에너지성능을 잘 알 수 있고, 사용될 에너지의 전체를 계산할 수 있고, 라이프 사이클 등을 미리 알 수 있다. 그래서 4D모델이나 5D모델을 이용하면서 시공인원이 잘 판별하면 위험을 예방하거나 옮길 수 있다. 특히 시공환경 분야, 시공소음, 수질 오염 등의 문제점을 분석할 수 있다.

친환경공사는 복잡하고, 시간주기도 길어서 자원과 에너지를 많이 소모하기 때문에 친환경위험관리에 적합한 판별이 필요하며, 이를 통해 지속 가능한 발전을 할 수 있다.