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Integrated Construction Process for Green Building

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Abstract

Green Building is rapidly becoming a strong momentum in the construction industry after recognizing many negative environmental issues & problems and potential social and economical benefits. In green building, all stakeholders including an architect, a contractor, engineers, etc. need to collaborate to successfully complete integrated green design and construction that can eventually achieve the goals of sustainability in construction. Since there are many negative environmental issues and problems as well as many opportunities, it is very important to develop an Integrated Construction Process (ICP) f that can help all stakeholders to successfully implement green building strategies and technologies at the construction phase of the project development. Thus, this study develops an 'ICP' including goals of green construction processes, step-by-step procedure, the roles and responsibilities of three main stakeholders such as an architect, a contractor, and subcontractor that can help all stakeholder to achieve sustainability at the construction phase.

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INTRODUCTION

Sustainability in the built environment has gained popular momentum over the 25 years to enable all people to meet their basic needs and improve their quality of life while save our natural resources and diversity [1]. In the building industry, buildings are responsible for 41% of total U.S. energy consumptions [2], 73% of electricity

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consumptions [3], and 39% of CO₂ emissions in the United States. Thus, the stakeholders in the building industry have adopted the concept of sustainability in all construction activities. To achieve the goals of sustainability in the building sector, green design and construction principles offer a way for the construction industry to introduce numerous benefits, including better energy efficiency, improved indoor environmental quality, increased health and occupant productivity, and the minimization of resource usage, into the construction process and throughout the lifetime of the building [1, 4-7].

In healthy green buildings, integrated and comprehensive processes and approaches are implemented during the planning, design, and construction phases of a building's lifecycle to satisfy this holistic perspective and collaboration [8]. Green building involves many different stakeholders, including architects, engineers, contractors, construction managers, owners, building occupants, building operators, and government agents, all of whom must fully commit to the project to ensure the success of the integrated design and construction processes that are the bedrock of green building [1, 9]. One of the major success factors related to green building is the use of an integrated process that involves an intricate, multidisciplinary collaboration between a wide range of stakeholders, all of whom work closely together to generate innovative and effective green building solutions [5, 10]. In green building, an Integrated Design Process (IDP) at the design phase is a key for success in implementing green building strategies and technologies in a green building project. Thus, many studies have emphasized the importance of IDP and developed an IDP framework and tool at the design phase that can help stakeholders facilitate IDP with step-by-step procedures. In addition, the IDP is a holistic approach to building design since an IDP design process could produce more significant results and provide the means to apply the design strategies and move society towards sustainability [11]. Even though a holistic approach at the design phase is a key for green building, it is also very important to make a holistic or collaborative environment at the construction phase to promote collaboration among all stakeholders at the construction phase. However, there is a few studies have been conducted in "Integrated Construction Process (ICP) for Green Building" at the construction phase of the project development. Thus, this study develop an ICP framework that can promote collaboration among all stakeholders at the construction phase, guide green building strategies and technologies, provide step-by-step procedures to achieve green construction strategies and technologies, and provide roles and responsibilities of major stakeholders with detail case studies. The outcomes of this study can help major stakeholders including an architect, a contractor, and major subcontractors to successfully implement green construction strategies and technologies at the construction phase of the project development that can eventually achieve the goals of sustainability in the building industry. In addition, the new ICP model can also serve as a useful education and training tool for green construction that will help construction professionals to learn about their sustainability and professional responsibilities and the resulting benefits for the construction industry as a whole.

BACKGROUND AND LITERATURE REVIEW

Construction activities have a major impact on physical development, government policies, community activities and welfare programs. However, over their entire lifecycle, construction activities are also connected with the broader problems and issues affecting the environment, including global warming, climate change, ozone depletion, soil erosion, desertification, deforestation, eutrophication, acidification, loss of diversity, land pollution, and consumption of valuable resources such as fossil fuels, minerals and gravels [1, 2, 12, 13]. In an attempt to address these issues and problems, the building industry in many countries has begun to implement green building methods and technologies. To achieve benefits of green building, the project team needs to shift to more integrated processes in all phases of a building's life cycle [14]. Tasks in green building are not completed by a single action or entity but require a multidisciplinary team approach and the implementation of iterative processes during the building's design and construction. At the construction phase, careful attention must be devoted to both design strategies and construction opportunities for ensuring that a project is delivered in a sustainable fashion. To successfully implement green strategies and technologies during the construction phase, a range of green strategies and technologies can be deployed to achieve the goals of green building. Construction opportunities here include preconstruction services, minimizing site disturbance, erosion and sedimentation control, pollution prevention, sustainable site operation, construction waste management, indoor air quality management, green materials management, and commissioning, among others [1, 15].

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