

# **A Systematic Approach to Introduce BIM in Existing Undergraduate Construction Management Courses**

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Building Information Modeling (BIM) has been employed increasingly by the architecture, engineering and construction (AEC) industry during the past decade. The SmartMarket Report has shown that BIM adoption in North America increased dramatically from 28% in 2007 to 71% in 2012, and 86% of contractors have been using BIM for more than 3 years by 2013. As a result, the demand and industry expectations for construction management (CM) graduates with BIM knowledge have also been growing. While a number of universities have started new courses on BIM, many CM programs have been struggling with how to introduce BIM into their curriculum. The program may be short-staffed, or it could be difficult to hire a well-experienced instructor because of high industry demand. Due to various reasons, having additional courses in the curriculum to introduce BIM is not an optimal or even feasible option for some CM programs. This paper presents an alternative approach that introduces BIM to an undergraduate CM program by dividing BIM knowledge into specific subjects and systematically incorporating them in existing CM courses in the curriculum without having additional courses. The approach will be implemented in a CM undergraduate program which has a relatively small number of faculty with a full load of teaching and advising assignments. Ten CM courses have been determined to have the potential to be incorporated with BIM contents and establishes the framework of the approach. These ten courses cover most core subjects in the CM program including construction graphics, construction materials, construction methods, cost estimating, structural analysis, mechanical systems, construction scheduling, and project management. The ten courses include both required and elective courses and are available to CM students from freshman year to senior year, and therefore form a progressively structured framework. Each course incorporates certain BIM materials that are specifically related to the course subject. The BIM platform from Autodesk has been selected for the proposed approach due to its popularity in the AEC industry. Two of its main BIM software, Revit and Navisworks Manage, as well as Robot Structural Analysis Professional, will be introduced in corresponding courses to apply relevant features in facilitating course contents. This systematic approach will be able to expose students to BIM knowledge and BIM software skills from their entry to the exit of the CM program. The framework has been partially implemented and the remaining is under development. Student feedback from completed courses with BIM contents incorporated has proved that the approach was very effective in teaching BIM materials and was able to additionally improve student motivation of learning text materials. When the framework is fully implemented, students finishing the CM program will have acquired BIM knowledge and software skills on all relevant CM subjects and will be ready for various career opportunities that requires BIM capabilities. The approach presented in this paper will also serve as a case study of how CM programs can implement BIM education more effectively using an alternative approach.