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Journal of Building Information Modeling

An official publication of the National Institute of Building Sciences buildingSMART alliance™

National Institute of Building Sciences: An Authoritative Source of Innovative Solutions for the Built Environment

Fall 2010

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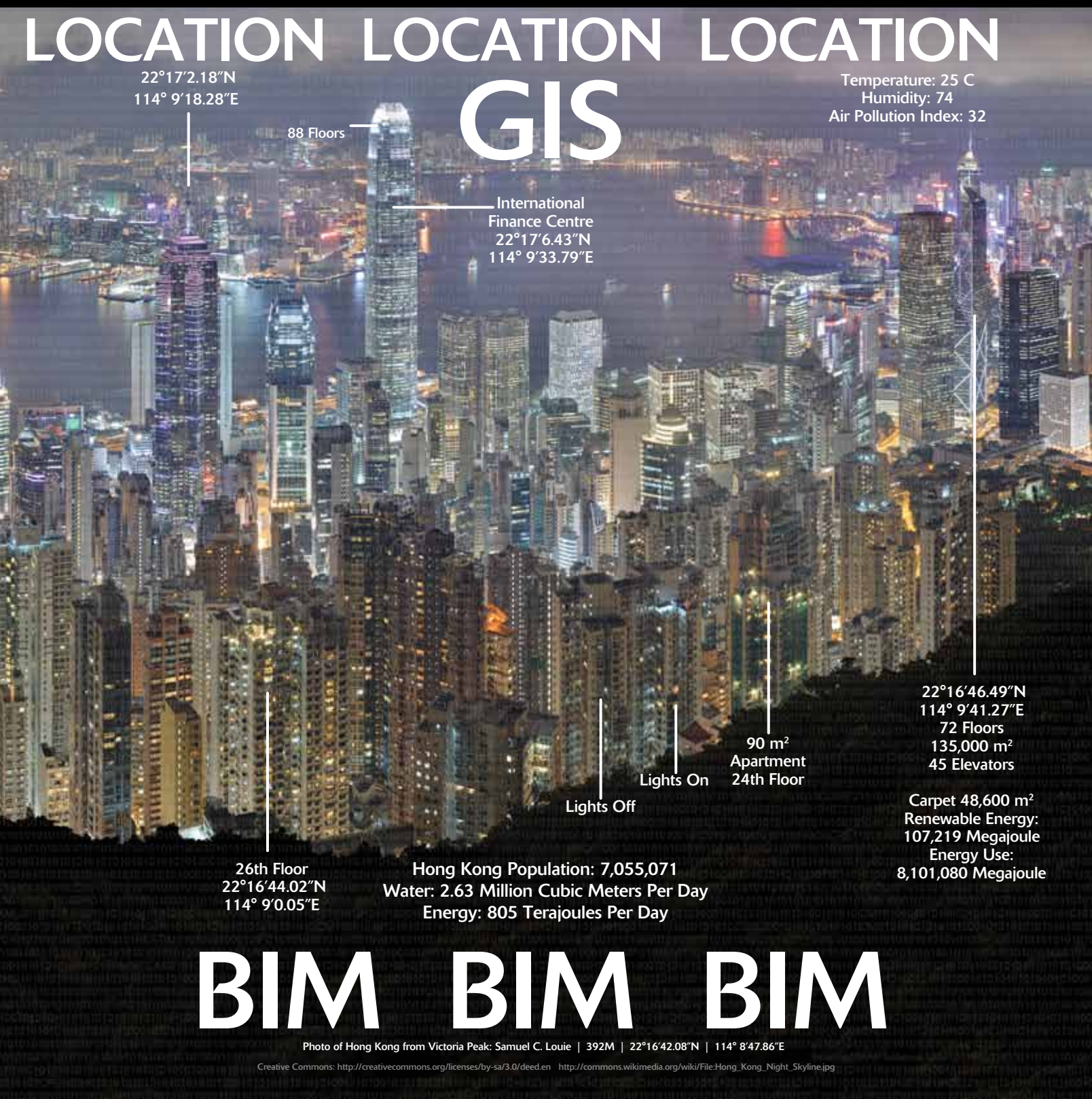

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Industry Expectations **Help Drive BIM** in Today's University Undergraduate Curriculum

By Allan Chasey, PE, LEED AP and Christopher Pavelko, EIT

OVER THE PAST FEW YEARS, THE construction industry has seen increased usage of technology to help reduce time and cost on projects[1]. New forms of collaborative software, such as building information modeling (BIM), are being introduced into the construction industry, helping the industry shift from the traditional design-bid-build process to a more efficient design-build process[2]. What core competencies are needed for new graduates to ensure qualified personnel are entering the construction workforce?

To gain a better understanding of the industry's current requirement with new technologies available, a survey was conducted to help understand what the construction industry desires from a recent graduate. A second survey was conducted among academic institutions to provide insight into what skills schools are providing students. A site visit to an academic institution was also conducted to obtain a more in-depth analysis of their teaching style, techniques and concepts. This research was supported by FIATECH, an industry consortium that supports the developing usage of new technology in the architecture, engineering and construction (AEC) industries.

INDUSTRY SURVEY

An information survey was sent to FIATECH members in September/October 2008. There were a total of 77 respondents, mainly representing engineering construction (EC) firms (47 percent) and combined architecture, engineering and construction (AEC) firms (25 percent). The companies are located throughout the U.S., Canada, Europe and the Middle East. The majority of companies (66 percent) are large companies with over 5,000 personnel and gross revenues of over $1 billion annually.

From the respondents to the survey, 56 percent indicated that they use a BIM-based software. Of those who indicated that they do not currently use BIM in their company, 46 percent plan on using BIM in the future. This indicates that approximately 77 percent of companies ultimately foresee using BIM in their future work.

Results from this survey indicate most companies use BIM for design, concept development and construction documents. Fewer companies use BIM for estimating, the procurement process and turnover to the owners **(FIGURE 1)**.

An objective of the research was to understand the knowledge-base expected for new hires to suggest educational curricula that will support the industry expectation. From this survey, industry expects new hires to have a grasp on skill knowledge (95 percent) rather than knowledge pertaining to a particular software program (5 percent). As indicated in **FIGURE 2**, the majority of companies (70 percent) expect new hires to have a working knowledge of 2D line drawings for use as construction documents. This is expected more than the ability to develop and work with conceptual modeling (56 percent).

ACADEMIC SURVEY

The academic survey was developed to gain an understanding of the current state of BIM implementation into the curriculum at academic institutions. Construction-specific education programs were targeted but the survey also included schools with architectural and engineering programs having a construction focus. The survey was sent to academic members of the Associate

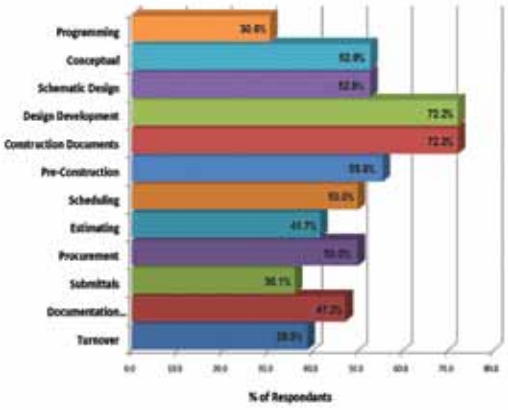

Figure 1. Industry use of BIM (n= 36).

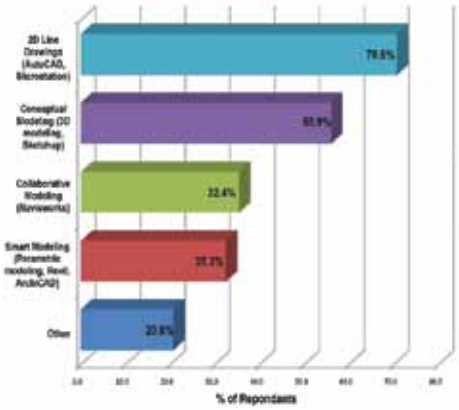

Figure 2. Level of knowledge expected by the industry.

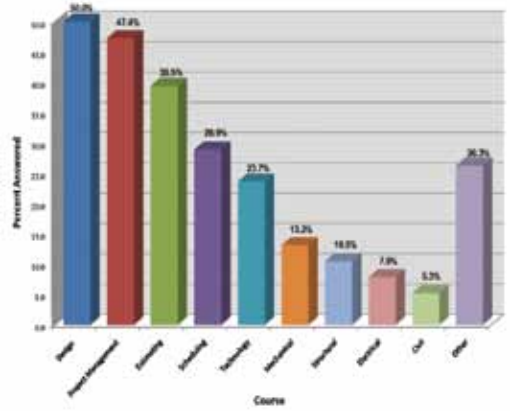

Figure 3. Courses Utilizing BIM (n=38).

Schools of Construction (ASC), the American Council of Construction Education (ACCE), the buildingSMART alliance™ and FIATECH.

Of the 59 respondents, 70 percent indicated they integrate BIM into their curriculum, with several noting that they are just starting to develop their curriculum. For those not currently implementing BIM into their curriculum, 88 percent indicated they plan on doing so, suggesting that 97 percent of all respondents will have an element of BIM in the curriculum in the near future.

From those who indicated they were using BIM in their curriculum, the majority taught in a combination format. **FIGURE 3** indicates the types of classes being taught utilizing BIM, including design-based classes, project management, scheduling and estimating. These correlate well with what the industry desires. The degree of modeling implementation is shown in **FIGURE 4**. The majority of those who teach BIM only teach 3D modeling, with less than half tying in schedules and cost to the model.

CURRICULUM EXAMPLES

With the surveys completed, several schools with more advanced BIM implementation were studied and a site visit was undertaken to Pennsylvania State University's (Penn State) Architectural Engineering Department to discuss BIM implementation and the use of technology into the classroom. This school was chosen based on the degree of BIM implementation and the number of classes using BIM. Since it is a design school, BIM software helps the students better visualize the design as well as use the same information in the construction phase. This assists with quantity determination, installation coordination, project scheduling and other construction operations. This spans several classes within the five-year program. The ability to retain the software skills needed is easier when spread across several courses.

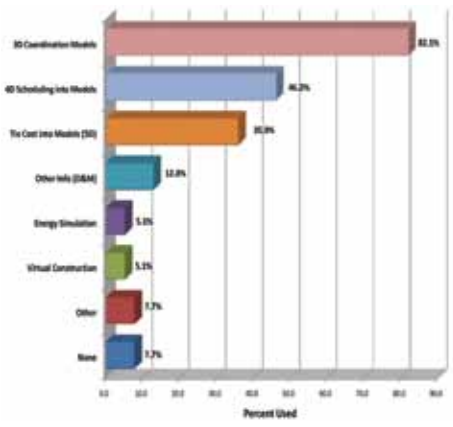

Figure 4. BIM Implementation in Curriculum (n=39).

Penn State has also developed an Immersive Construction Lab consisting of a computer with three projection screens, 3D glasses and a smart board. This allows students to fully visualize a project and gives them the ability to collaborate with others while working on projects.

Arizona State University's Del E. Webb School of Construction implements BIM in a senior level project management class. The BIM lab is taught by industry professionals so the students gain a basic understanding of the software and can develop skills associated with the construction process. Classroom lectures provide the tie between BIM and project management, with industry professionals (designers, general contractors and subcontractors) visiting as guest lecturers to discuss the benefits of BIM in their segment of the industry. Each semester, the curriculum in the class is refined based on lessons learned and with direct input from industry. With such input, the class can remain aligned with the most current technology implementation in the construction industry.

The curriculum requirements for design and construction programs are different. Design focuses on producing construction documents, working with a BIM during design into construction. Construction deals with the advantages of utilizing a BIM to benefit the work flow and processes during execution.

CONCLUSION

The increased use of technology and tools such as BIM in the construction industry has provided companies benefits by saving time and money and increasing productivity. BIM is becoming a cornerstone in the industry and is now required by many owners. The rapid increase of use has pushed the academic community into developing curriculum to match industry's needs. The industry desires students to possess a working knowledge of the construction process and how technology can benefit key skills needed such as scheduling, estimating and project management. Learning to communicate and work collaboratively with owners and with design and construction teams is another key skill BIM usage benefits.

At the time of this survey, the majority of schools were starting to implement BIM into their curriculum. Teaching students BIM concepts and skills through a lab/lecture combination is an ideal way to teach the students while tying the skills to a model for scheduling, estimating and understanding and visualizing drawings. This allows industry skills to be developed along with an understanding of how to use the BIM tool in a more real world scenario. This technique can be used whether through one dedicated class or across several classes that teach different skill sets. As BIM is further developed, the key will be to continue to tie industry to the classroom to support the industry expectations and needs. ■

This research was funded by a grant from FIATECH as part of the Knowledge Enabled Workforce Element of the Capital Projects Technology Roadmap.

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