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BIM for Electrical Construction: Benefits and Current Trends

By Salman Azhar, Ph.D.

THE ELECTRICAL CONSTRUCTION INDUSTRY traditionally relies on 2D and 3D drawings to layout, design, estimate, and install power and communication systems in buildings. With the advent of building information modeling (BIM), electrical contractors have begun to experience its potential benefits. The scale of BIM adoptability in the U.S. electrical construction industry, however, and its impact on electrical design and construction, are still unknown. Keeping these objectives in mind, this research study was carried out with the support of National Electrical Contractors Association (NECA). The necessary data was collected via two questionnaires sent to NECA members from January to April 2009. The purpose of the first questionnaire was to gather data about the current status of BIM adoptability in the U.S. electrical construction industry while the second questionnaire collected information about BIM benefits and opportunities for electrical contractors.

The first questionnaire was completed by 185 NECA member companies. Though the survey targeted companies of various types (main job function) and sizes (in terms of annual revenue), the majority of responding companies were medium to large in size with their major focus on electrical construction. Results from these companies, which were located all over the United States, indicated that 38 out of 185 responding companies (21 percent) are using BIM technology in their projects. The following information is collected from these 38 companies.

When asked about the most valued BIM features for electrical construction, the following responses were obtained: clash detections (83 percent of users), visualization of electrical design (78 percent), space utilization (67 percent), partial trade coordination (53 percent), shop drawings review (42 percent), virtual mock-ups (39 percent), shop fabrication process (36 percent), walk-throughs (36 percent), design

validation (31 percent) and energy analysis (14 percent).

The next question asked was about the electrical components. These percentages show components which are typically modeled: branch and feeder conduits (92 percent), electrical rooms (89 percent), cable trays and other supports (86 percent), equipment panels (84 percent), lighting fixtures (76 percent), underground conduits (73 percent), junction boxes (49 percent), specialty lighting supports (46 percent), hangers (46 percent), outlets and switches (32 percent) and cables (22 percent).

Next, data about BIM benefits and implementation costs was collected. As a whole, the majority of respondents indicated that BIM technology is significantly helping to improve the process of delivering a facility. When asked about overall effects of BIM on the projects' performance, 70 percent of respondents reported "some-to-significant" time and cost savings. Furthermore, 64 percent of the respondents indicated that BIM helped to improve the quality of work put in place, while 18 percent indicated that the use of BIM nearly eliminated rework.

As far as the BIM implementation costs are concerned, a wide range of responses were received, ranging from \$2,000 to \$50,000, with the average falling just under \$13,000. These costs are subject to a number of factors such as organization size and the level of implementation. Given the fact that 70 percent of survey respondents experienced some cost savings, it can be inferred that BIM technology has the potential to payback quickly.

The last part of the first questionnaire was focused on companies that are currently not using BIM (79 percent of respondents). When asked why not, the top five responses were:

- Do not know about BIM (64 percent);
- Lack of technological experience/expertise (24 percent);
- Existing software not compatible (13 percent);
- Too expensive (11 percent); and

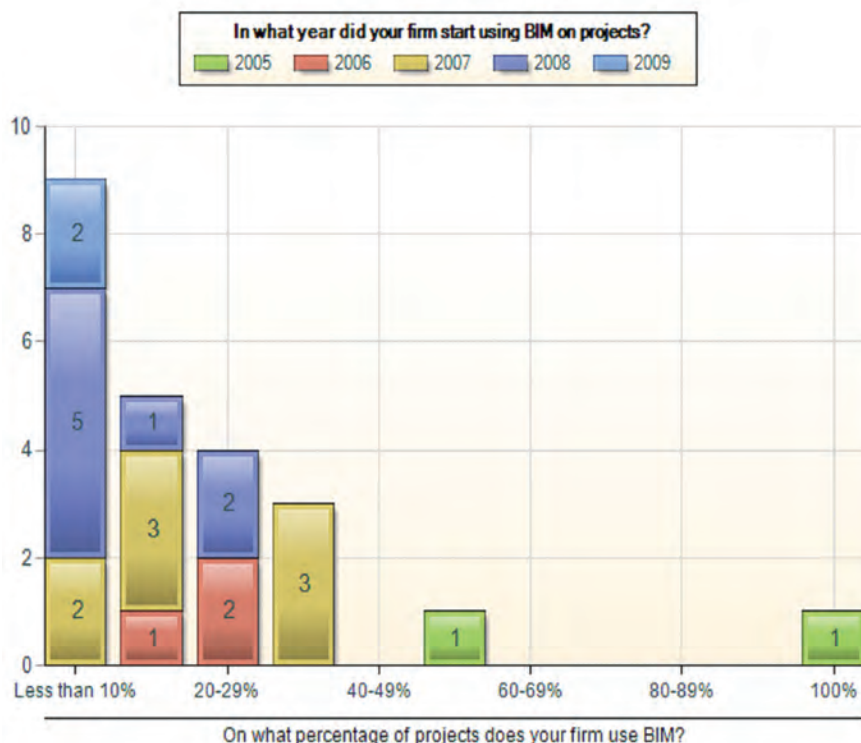


Figure 1. Year of BIM Adoption and Percentage of BIM-based Projects.

- Not required by customer or design team (8 percent).

The second questionnaire was sent to those 38 companies which were using BIM at the completion of first questionnaire. The purpose was to collect more specific information about BIM benefits and opportunities for electrical contractors. Twenty-three (61 percent) companies responded to this questionnaire.

The first question inquired about the percentage of companies' projects for which a building information model was developed. As per results, most electrical contractors used BIM for less than 10 percent of projects (9 respondents). The "between 10 to 19 percent of projects" option received 5 responses; 4 respondents selected 20 to 29 percent; while 5 respondents indicated that 30 percent or more of their projects are developing a model (FIGURE 1). It is also found that the companies who adopted BIM earlier are using this technology on a higher percentage of projects and vice versa. As companies adopt new technology, time and experience are typically required to obtain a positive outcome. With the exception of one electrical contractor who experienced a significant loss, survey results indicated that 15 of the 23 respondents found that the BIM

technology helped to make the project more profitable. Six respondents either did not answer this question or they were not sure.

This study also identified the effect of BIM on the numbers of RFIs and Change Orders (COs) generated over the project life cycle, compared to similar projects in the respondents' companies. Based on 23 responses, it appears that 14 electrical contractors were able to reduce the amount of RFIs, 6 contractors reported no change, while the remaining 3 experienced more RFIs than a similar project that did not use BIM. Almost similar results were obtained for change orders. When this data was analyzed with respect to the BIM experience, a positive correlation was found between the "Less Number of RFIs/COs" and "More Years of BIM Experience". Hence, it can be inferred that the more BIM experience the companies have, the more benefits they achieve.

At the end, the impact of BIM on the overall business was assessed by examining how the key performance indicators (KPIs) have changed since the adoption of BIM. The respondents were asked to consider changes in quality control (regarding the amount of necessary rework), cost, timely completion, safety and productivity. Given the options, ranging from "negatively" to


"positively" effected, respondents rated the impact of BIM on each of these KPIs. Interestingly, there was no "negatively" responses selected for any KPI, while "slightly positive" responses dominated four out of the five KPIs, as shown in TABLE 1. It was found that BIM has the most effect on quality control, followed by productivity, cost, schedule and safety.

In a nutshell, BIM is still an emerging technology in the electrical construction industry. About 21 percent of surveyed companies are currently using BIM, and are reporting positive savings in time and cost for the project, while improving the work put in place, thereby decreasing rework. For those 79 percent of companies not using BIM, the major reasons are unfamiliarity with BIM technology, followed by a lack of technological experience. While BIM may not be an appropriate business venture for all electrical contractors, as it requires substantial investment and training, it certainly does provide many benefits to its users. ■

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Answer Choices							
	Negatively	Slightly Negatively	No Change	Slightly Positive	Positively	Weighted Score	Rank
Point Value	-2	-1	0	1	2		
Quality Control/ rework	0	2	1	9	11	29	1
Cost	0	2	6	14	1	14	5
Timely Completion	0	3	5	12	3	15	4
Safety	0	1	9	9	4	16	3
Productivity	0	2	3	13	5	21	2

Table 1: Effect of BIM on Project's Key Performance Indicators (KPIs)



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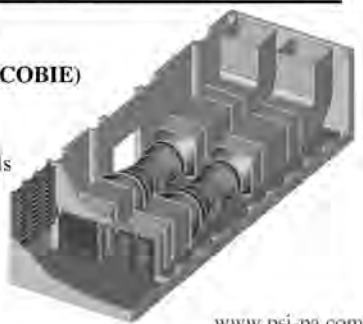
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