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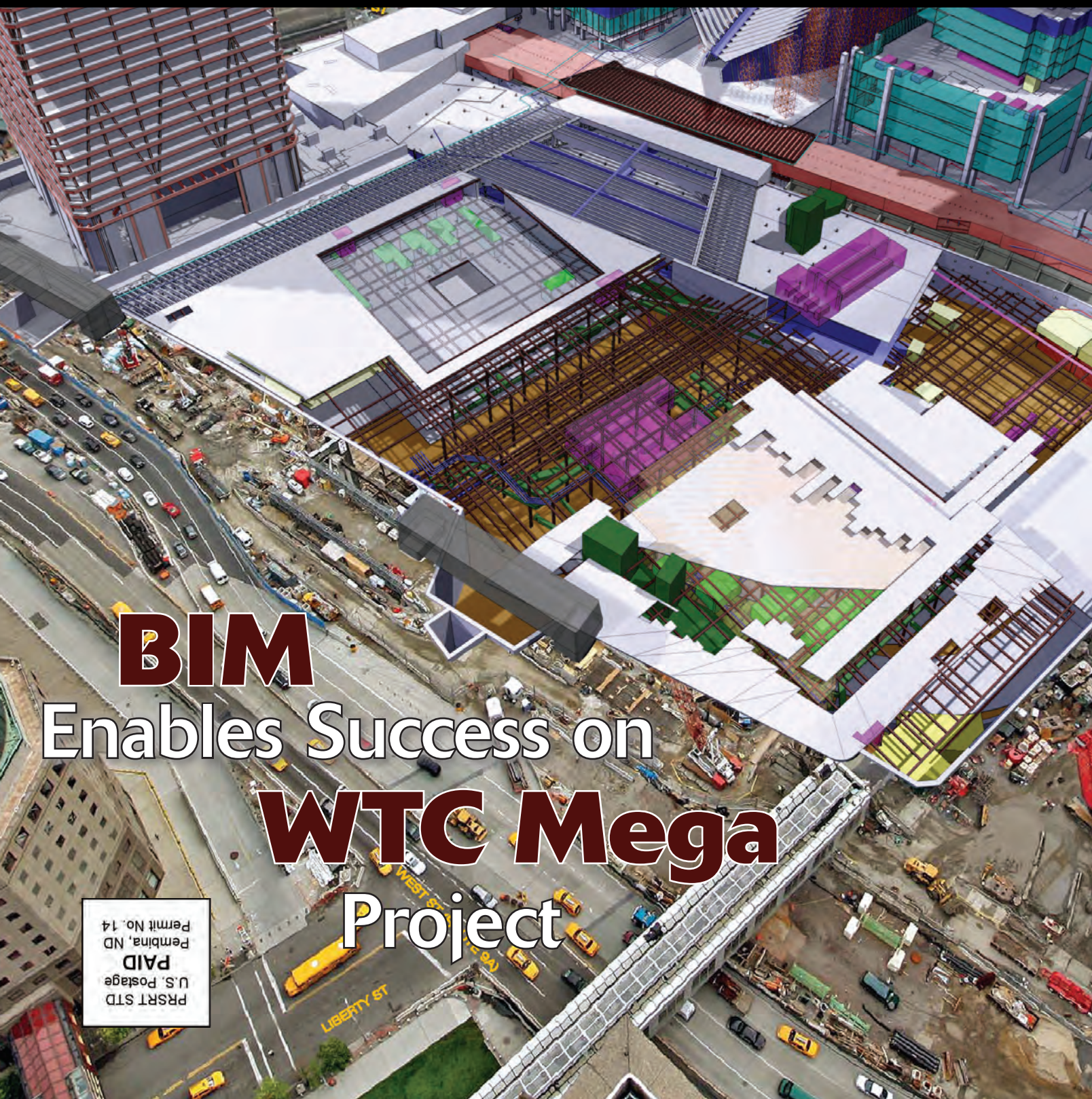

BIM Enables Success on WTC Mega Project

A Modest Proposal for a Transdisciplinary Curriculum for the Design, Construction, Management and Maintenance of Architecture

By Lamar Henderson, RA, and Nancy L. Jordan, Ph.D.

TO DATE, THERE IS AN IMPRESSIVE body of literature—studies, essays, reports, manifestos, blogs, etc.—that have attempted to analyze and propose solutions to the existing pedagogic issues in architectural education. Historically, most departmental-based courses of study at the university level (graduate or undergraduate) have emphasized a narrow curriculum. Typically, each department owns and teaches a separate knowledge set and each member of that department owns and teaches an even more narrow knowledge subset.

Yet, real-life architecture demands that practitioners have a more multifaceted knowledge-base and ability—not just in design, but also in fields such as engineering, energy management, economics/finance, technology/information systems, construction management, building maintenance, and environmental science. Unfortunately, the standard of narrow and separate precludes practitioners leaving the university with the complex skills necessary to meet the current and future job requirements in architecture.

THE SHIFT

BIM is an acronym not only for the term building information modeling, but it also represents a paradigm shift in the way we think about buildings and their design, production and maintenance. This new paradigm is the synthesis of many emerging trends within the larger global culture of architecture. Currently, building professionals are in the process of transitioning from an analog tool system to a digital tool system.

This system is still in the process of its own evolution. As we better understand our needs, we will be able to design those needs into the software. Furthermore, we are not only concerned with the adoption of this new (in-process) tool system, but also with understanding and implementing the social and cultural strategies of a different design, construction and management process for the built environment. Thus, the paradigm shift not only encompasses the software, but also the skill-sets necessary to implement this new paradigm.

THE BIM PARADIGM

In order for building professionals to practice within this new paradigm, they need to understand the properties and skill-sets used by practitioners throughout the life cycle of a building project. Not only do professionals need to be educated in the traditional skills related to project design, engineering, construction, management and maintenance, but they also need to have additional skill-sets to practice within this paradigm. These skill-sets include knowledge of data management, information technology, energy and material conservation, integrated building design, systems thinking, life cycle analysis, the design processes, business and marketing skills, and project finance. As this new paradigm evolves and grows, additional knowledge and skills will become applicable to the design process in the future.

In addition, this paradigm requires a collaborative design process. Due to the growing complexity for building, it will be impossible for any one professional to have all the knowledge and skill-sets. All building professionals will need to learn to have respect for and value the skills of others, as well as their own skills.

Thus, the BIM paradigm necessitates the development of an educational program that prepares building professionals for an ever-evolving profession within a collaborative work culture.

CURRICULUM FRAMEWORK

Many undergraduate programs in colleges and universities today have been formed in reaction to marketplace competition and as a direct path to employment. These programs (narrow in scope) are most concerned with teaching students the essential facts that they will need to know in order to perform in their chosen occupations. Yet other professions, such as law and medicine, prefer to educate their students in carefully planned graduate programs after selecting their students from undergraduate programs in the liberal arts. Why is this?

A liberal arts undergraduate education provides students with more than facts. While emphasizing a well-rounded curriculum in the humanities, history, the social sciences, math, science, and the creative arts, it teaches students to think independently and flexibly, solve complex problems, inquire, conduct research, collaborate with others, and adapt to our ever changing world. Students discover new perspectives and at the same time, come to understand our shared inheritance—the cultural ties that bring us together. Knowledge is considered for its own sake and for how it shapes our world.

Most importantly, a liberal arts education prepares students for leadership in their chosen professions and would provide pre-architecture students with much stronger foundations from which to construct

their knowledge and abilities as they pursue an advanced degree in architecture.

What then would a graduate program that teaches the skills necessary to practice in the much more complex BIM paradigm look like? It might consist of a core program taken by all students. This core program would create an environment in which the students would continue to practice using the tools that they learned from their undergraduate liberal arts education while learning all aspects of the life cycle of the building process.

This core program would be a prerequisite for specialized study as well as for a terminal degree—for those individuals seeking a generalist degree. Specialized study would continue after the core program for those seeking certification and licensure in specific professional areas (as required by state licensing boards and other certification programs), such as architecture, interior design, etc. Most importantly, as the BIM paradigm continues to evolve, courses and internships could be added, changed and dropped to insure flexibility, and to make sure that graduates leave with the tools necessary to be innovative leaders in the life cycle of the buildings that they design.

TEACHING FOR THE FUTURE

As the building profession has become more complex, students need more complex abilities and knowledge to be not only successful, but to become leaders within the industry. Courses need to be more than the transmission of facts because learning and building are intricate and multidimensional, creating and expressing different realities. The point where learning and architecture (the life cycle of building) connect should be dynamic. Both architecture and learning are, by nature, constructive, creative and social. Due to this, classrooms within the BIM paradigm need to be places of inquiry, fostering different views and capitalizing on the constructive, creative, and social nature of building and learning.

Thus, learners in this model would need to be responsible for their own learning by setting their goals, solving their problems and developing their skills. They would also need to learn in social, collaborative and experience-based classrooms. Teachers would need not only to be experts in their particular areas of expertise, but to be facilitators of learning. Their classes and course content should be dynamic—like the learning and building for which they are responsible—evolving and changing depending on the needs and interests of their students.

The teaching role in this paradigm would be more complex. Not only would the teacher serve as expert, but also as participant, inquirer, facilitator and learner. The classroom would become a workshop. Students would be active contributors and collaborators. Together, teachers and students would learn new ways to respond, create, and think about architecture and build smarter for the future.

RESEARCH

Since the BIM paradigm is a very recent transition from the historical practices of building design and maintenance, the research opportunities to explore the new paradigm are enormous. One of the most critical aspects of any research program is the ability to develop useful and productive research programs. Since the staffing of the program will contain practitioners, their insights from practice can provide specific topics for research.

A high-quality research program should use multiple research designs and tools. Research from this program should inform

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theory and practice, be used in teaching, used in the design process, and contribute to the knowledge of the building field. Tools to do modeling, simulation, and analysis for the life cycle design of buildings would need to be developed.

A research design might involve the development of digital "scientific instruments" to support the study of the life cycle of buildings. For example, these instruments might analyze and evaluate "what if" scenarios and strategies for resource and energy conservation designs. Another research design might use qualitative research methods. These methods are best suited for capturing multiple realities and describing complex social realities. If we are to more fully understand the life cycle of buildings, these methods will be useful. In addition, conducting research which investigates the development of collaborative skills—specifically oriented for the building professionals—might contribute to improving and changing how building professionals work collaboratively to build in the BIM paradigm.

CURRICULUM WITHIN THE UNIVERSITY

The proposed graduate program can only work within a major university with a strong liberal and academically diverse curriculum. Since the proposed curriculum is a graduate program within a research university, existing curricula related to the building industry will need to be merged into the new program. A core faculty will be needed to develop the core curriculum. Hopefully, faculty from other disciplines would be willing to develop appropriate courses for this new curriculum, thereby reducing the number of new hires.

The focus of the post-core classes will be project workshops which would be taught by a team of practicing professionals. These workshops would apply the knowledge learned by the student in specific building projects. The various professional organizations which support the building industry would be active participants in the development of the curriculum, as well as providing industry support. Through these professional organizations, it would be hoped that donations from the industry would support the development of the program.

CONCLUSION

The evolution of the BIM paradigm and its adoption by the building industry suggests that the education of building professionals has to be redesigned. The collective and evolving knowledge of this paradigm can provide a framework from which a comprehensive program of education—which accommodates the future needs of the industry—can be built. If we are to design sustainable architecture for its life cycle, the pedagogic framework constructed here for educating building professionals begins, hopefully, a conversation to rethink how we educate building professionals. ■

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