

Constructing college, university buildings wisely

Engineering mechanical, electrical, plumbing (MEP), and fire protection systems in colleges and universities requires designers to look toward the future of postsecondary education, and consider all aspects of a building and its occupants.

CSE: Please describe a recent college/university project you've worked on.

Aravind Batra: The recent project we worked on involved a new student union building (Aztec Center) at San Diego State University that achieved U.S. Green Building Council LEED Platinum certification. The building included meeting centers, retail spaces, student support centers, ballrooms, theaters, and offices. The design included a number of sustainable elements including radiant cooling and heating systems, energy-efficient lighting and occupancy and daylight controls, rainwater harvesting, and high-efficiency toilets.

Craig Buck: RMF was recently involved in designing a new 66,000-sq-ft facility at Clemson University called the Watt Family Innovation Center. The building was designed with group collaboration and flexibility in mind, using a raised-access floor system with demountable wall partitions. There is a large atrium across the front length with a large

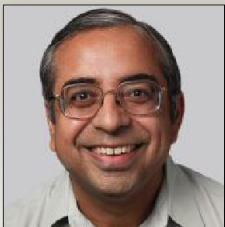
LED media mesh screen across the front exterior. The LED media mesh screen is 210x24 ft with LEDs on 4-in. centers. The building includes innovative technology and connectivity to other areas on campus as well as the ability to share information with other groups across the globe.

Jeffrey R. Crawford: Ross & Baruzzini recently completed design of mechanical, plumbing, fire protection, and audio/video (AV) systems for a \$40 million reconstruction and renovation of the Lafferre Hall Engineering Complex at the University of Missouri in Columbia. The project included the demolition and reconstruction of roughly 51,000 sq ft of engineering laboratory and laboratory support space and the renovation of approximately 68,000 sq ft of classroom and office space, as well as mechanical infrastructure upgrades to other areas in the complex that includes building additions ranging from the year 1892 to 2009. The project will create highly flexible state-of-the-art laboratories and classrooms to support a wide variety of research and teaching activities and

equipment. Numerous sustainable features were incorporated into the design, and technology is a critical feature in the classrooms to facilitate student group interactions with faculty and entities outside the building complex.

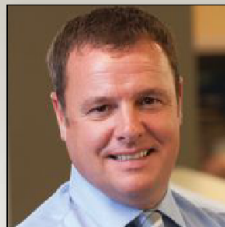
Andre M. Hebert: The Steidle Building Renewal at Pennsylvania State University in State College consisted of a total renovation and addition to the 1931 Steidle Building to house the Department of Material Science and Engineering. When completed in spring 2016, the project will encompass 105,000 gross sq ft of research and teaching labs, offices, classrooms, meeting rooms, and collaboration spaces. The labs include 79 high-performance fume hoods and other specialized ventilation systems to support the research and teaching mission.

Sergiu Pelau: We've recently completed Cornell Gates Hall building in Ithaca, N.Y., providing MEP, high-performance building design services, and architectural lighting design services. The building is approximately 100,000 sq ft, and its primary focus was to consolidate the



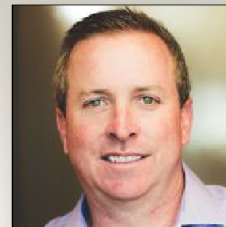
Aravind Batra, PE, LC, LEED AP

Principal
P2S Engineering Inc.
Long Beach, Calif.



Craig Buck, PE, LEED AP

Associate
RMF Engineering
Charleston, S.C.



Jeffrey R. Crawford, PE, LEED AP, CCS

Vice President, Director
of Higher Education &
Research Market
Ross & Baruzzini Inc.
St. Louis

Departments of Computer Science and Information Science (CIS) together in one facility. The building comprises computer classrooms, computer laboratories, offices, an auditorium, and collaboration spaces. It features convenient workspaces organized around an open atrium space encompassing four levels, and a covered entry plaza providing a space for social interaction outside.

Scott Robbins: One of the more interesting projects currently in construction is a major renovation to a Rare Book & Manuscript Library. The building opened more than 50 yr ago. It was in need of major MEP systems and architectural upgrades. Due to the unique translucent-marble-panel exterior skin, special HVAC systems are necessary to minimize condensation issues at the façade while maintaining required humidity levels for the six-story book-stack glass enclosure within the building. It requires special air-handling units (AHUs) and well-thought-out location of air distribution within the space.

CSE: How have the characteristics of college/university projects changed in recent years, and what should engineers expect to see in the near future?

Pelau: Trends that we see in higher education facilities are active learning; virtual classrooms; increased focus on science, technology, engineering, and math (STEM); and collaborative public spaces. We've noticed that university staffs have become much more involved



Figure 1: Engineers working on the Aztec Center student union building at San Diego State University incorporated a rain-harvesting system. It consists of two buried tanks used to store rainwater that is used for site irrigation. Courtesy: P2S Engineering Inc.

in the design process and more knowledgeable. Another aspect that has been changing recently is the year-round academic year. The buildings are no longer unoccupied during summertime, therefore MEP systems have to be designed for full occupancy during summer months. Sustainability is an area that has been taking a more central role in the design, and I would expect to see even more emphasis on green design and energy-conservation measures.

Robbins: Colleges and universities tend to have a long-term vision. They have staffs that are interested in systems that can have a more positive impact on the environment. It is our responsibility to provide them with the information so we can collectively make the best decisions for the project and university. We need to continue to push the envelope of energy-reduction measures where viable.

Crawford: There has been a growing focus on sustainability and the use of technology with all building project types on college/university campuses,

particularly with respect to awareness by the students, and I expect that trend to continue for several years to come. With respect to sustainability, I see a steady march toward net zero buildings, with renewable energy being an expected component of all new or major renovation projects. With respect to technology, interactive and virtual classrooms with a long-distance learning component will take the place of the traditional large lecture halls.

Batra: Colleges and universities have become more aware of their operational and maintenance costs and are constantly looking to reduce them by improving efficiency and standardizing their systems at their campuses. The projects also are focused on reducing or minimizing the natural resources by promoting sustainable design of facilities and reducing greenhouse gas emissions at each of their campuses. The next 1 to 3 yr will bring major investments in designing high-performance buildings that are approaching net zero or are net zero smart-energy



Andre M. Hebert, PE, BEMP, LEED AP BD+C
Principal, Senior Mechanical Engineer
EYP Architecture & Engineering
Boston



Sergiu Pelau, PE, LEED AP
Principal
Syska Hennessy Group
New York City



Scott Robbins, PE, CEM, LEED AP BD+C
Senior Vice President
WSP | Parsons Brinckerhoff
Boston

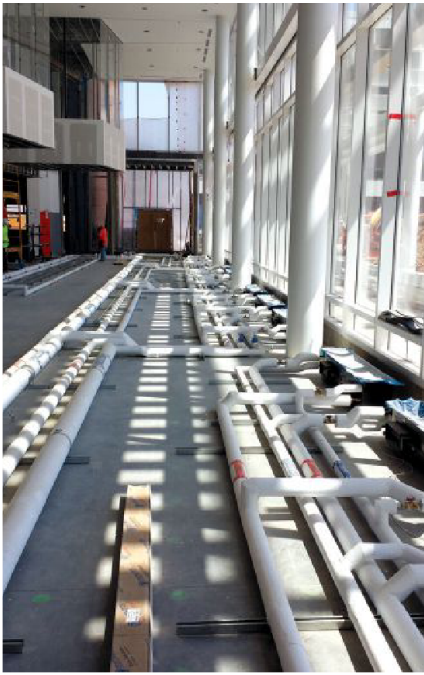


Figure 2: The Watt Family Innovation Center at Clemson University features an underfloor air distribution (UFAD) system. The engineering team handled the challenging aspect by dehumidifying the air using chilled water, then using some amount of return air from the building to reheat the air up to the required supply air temperature. Courtesy: RMF Engineering

MEP Roundtable

buildings, energy efficiency projects, renewable energy projects, and distributed-generation/smart grid projects.

Buck: In recent years, colleges and universities have focused on the programming and design of spaces where groups can collaborate and share knowledge. This has led to a lot of group spaces and common areas in conjunction with network connectivity and wireless technology.

CSE: On what aspect of college/university projects do you see the most emphasis being placed by building owners? In what area(s) is your firm doing the most engineering work?

Robbins: There continues to be a strong emphasis on how we can reduce the energy consumption of buildings while maintaining acceptable levels of

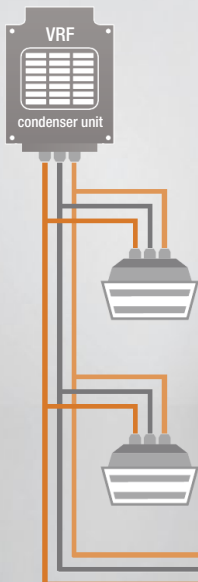
thermal comfort. Another big topic is resiliency. Universities are asking for more information about how they can improve the resiliency of their existing buildings and what is the impact on the design.

Hebert: Colleges and universities are well aware that the facilities they build or renovate today will likely remain in service for decades, and most are recognizing the ever-growing importance of the total and long-term cost of the buildings' ownership. Further, they expect these buildings to meet all the requirements for modern teaching and research facilities while having the flexibility to adapt to future pedagogies. Additionally, buildings must perform at extremely high levels from safety, energy, and maintainability perspectives. More than ever before, colleges and universities are demanding high performance from building systems, envelopes, finishes, and space use.

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Buck: It is highly variable and dependent on the types of owners with which we are working. We have clients who are extremely proactive and have specific and measurable goals in mind for each project. These goals typically drive the design, and we focus our design on the areas of most concern to those clients. We have other clients that are more reactive, unsure of the project requirements, and how to actually achieve them. Our design and engineering experience helps guide them toward goal development and the designs to achieve their desired goals.

Crawford: Colleges and universities continue to put a high level of emphasis on upgrading HVAC and building automation systems (BAS), as those have the greatest impact on energy consumption and operating costs. We are also seeing more emphasis being placed on technology (information technology, telecommunication, A/V, and security systems).

CSE: Describe your experience working with the contractor, architect, owner, or other team members in creating a BIM model for a college/university.

Pelau: We've recently completed the MEP/IT/AV and lighting design of Manhattan College Student Commons, which opened in 2014. The building, which is approximately 70,000 sq ft, was designed by Perkins Eastman Architects completely in Autodesk Revit. Syska's team used Revit MEP for enhanced collaboration between disciplines, as well as for system-clash detection. Working with Revit has allowed us to take a virtual 3-D tour from a 2-D drawing. This has resulted in greater efficiency with regard to coordination with the various design disciplines. Work-sharing and linking various disciplines into one central Revit model has

allowed us to have an updated, real-time design view on how ductwork and HVAC equipment relate to other disciplines, such as plumbing piping, structural beams, and architectural items. These conflicts and issues have been addressed and resolved during design.

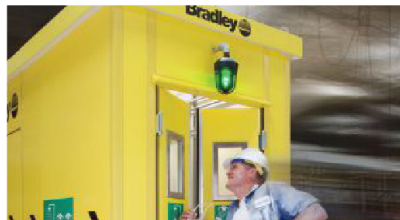
Buck: Our ability to use the full capabilities of BIM depends on the expertise of the contractors that get involved in the projects during construction. Some contractors have the ability to use BIM for coordination purposes while others do not have the same capabilities, which limits the full implementation of BIM during construction. This is also true with owners. Many owners want to use BIM after building turnover, but do not yet have the capabilities to implement BIM. Architects are very involved in the BIM process during design, primarily for coordination between systems. This leads to better designs and fewer coordination



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Advertorial

Annese Electric Completes Multi-Phase Retrofit Project of Fitchburg State University Library with Connectrac



"It was a huge project that had a lot of variables that came with it," said Connectrac Director of Sales Steve Batchelder. "We're happy Connectrac's flexibility worked well for the job Annese Electric put together."

The services of Annese Electric – an electrical contractor based in Weymouth, Massachusetts—were selected as the most viable bidder for a multi-phase retrofit at Fitchburg State University's central student hub, Hammond Hall.

In preparation of the project, Annese researched for a product that could affordably accomplish this goal without intruding on student activities and was flexible to work with future renovations. With multiple options presented to them, the team at Annese selected Connectrac Wireways.

Fitchburg State wanted to provide connectivity along the window railing in an upper floor in Hammond Hall where a study area is placed along a large glass window looking out over the campus. Using Connectrac's In-Carpet wireway, Hughes and his team brought the carpet all the way up to the window for a near-invisible aesthetic.

"It was easy to install everywhere," recalls Annese Electrical Foreman, John Hughes. "Connectrac gave us the flexibility to give power and data anywhere without core drilling or saw cutting and spending a bunch of money."

Annese Electric pulled off the multi-stage project seamlessly, so much so that they have brought in Connectrac for further cable management renovations within the library.

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Figure 3: The Lofts, a residence building in St. Louis's Washington University, is one of only nine U.S. Green Building Council LEED Platinum buildings in Missouri. Courtesy: Daniel Poole, Ross & Baruzzini Inc.

issues in the field; however, currently the industry is still printing 2-D drawings for bidding and construction purposes, so some of the advantages of BIM are lost between the true modeling and creating readable 2-D drawings.

Crawford: BIM has been a part of virtually every college/university project we've completed over the past few years. We have worked with the architects to complete fully coordinated 3-D models of the building and all major building system components, and then we have provided those completed models to both the owner and contractor for their use in operating the building and constructing the building, respectively. We have found the application of BIM in our projects has improved collaboration among the design team members, reduced contractor uncertainty and constructability issues, sped up the construction process, and aided operation and maintenance of the building.

CSE: When working on monitoring and control systems in college/university structures, what factors do you consider?

Buck: The biggest factors that we focus on are functionality and simplicity. It is critical that the controls operate the building in an efficient manner, and it is equally important that the owner operates

and maintains the system once the building is turned over. Overly complex systems are sometimes difficult to implement during construction and even more difficult for maintenance staff to maintain and operate. Creating a system that is simple and easy to operate means that the maintenance staff can better maintain the building and deal with issues as they arise during the lifetime of a building.

Crawford: Some of the main factors we consider when designing monitoring-and-control systems for college/university buildings are:

- Energy/sustainability goals of the college/university
- Knowledge base and capabilities of the facility's operation staff
- Expected occupancy profile of the building over the course of a year
- Type and complexity of the building systems.

Batra: The factors we consider are current installation of controls: Are they proprietary or are they open to a more open protocol system? Do they have a migration path from proprietary to fully open? Do they have the ability to communicate to central monitoring systems with an open architecture?