DRAFTING A NEW VIEW FOR MODELING

PREPARED FOR THE BERKELEY-STANFORD CEM WORKSHOP

John P. May
(408) 988-1260 (field)
(408) 534-2869 (office)
E-mail: jmay@rosendin.com

To quote Robert Service, "I ain't so wise as them lawyer guys...". My expertise on the future of the CEM industry occupies a very small niche: electrical drafting; yet I was privileged in 1997 and 1998 to work on the Sequus project for Rosendin Electric Inc. With this insight I'd like to describe my task, and share my perspective on the future of electrical drafting if Sequus portends the future of electrical power and lighting design. My views are only mine and no one else's.

Although much exists about 3D design in mechanical engineering and architecture, there is nothing offered in the trade literature for electrical light industrial engineering. I cannot speak for the other disciplines, but after the architect prepared the 3D building for us, we at Rosendin were on our own. No 3D symbols (instances) existed, so I created my own lights and outlets and switches. Since the entire project was in AutoCAD, I used both the surface and the solid modeling to create my symbol block library. Initially, I used the 3Dpolyline for my conduit runs.

I first thought my task was to imitate exactly how the power would be run through the model like it was on an actual job: the estama- ting software would use this for takeoffs. My receptacles conventionally were 18" from the floor with exceptions for counters. Following the 2D design, I ran my conduits through the walls and up to J-boxes; from the J-boxes, the power ran to the panels, and from there to a transformer. Next it went to the Main Switch Board (MSB) and from there to the PG&E stepdown transformer outside. The model we turned out reflected the electrical design done in 2D, and served well for the estimating takeoff software. This, however, was the initial trial: it lacked the practical constraints of time and revisions. Aesthetics were also a forlorn factor because it wasn't needed for estimation purposes and realism, even with a fair time latitude, was too labor intensive.

During this first trial, the complexity of my 3D task varied. Making the library was pretty much a textbook exercise: creative and simplistic, although some time was put into it. The job of wiring up the power and lighting was tedious and demanding because using the 3Dpoly command demanded the concentration of visualizing and then running the lines in x, y, and z using only the World Coordinate System (WCS). I was spared the task of putting curves on the "conduit" because the command doesn't allow for it, although I now know the software exists to do just that. Through all the tedium, I gained a real appreciation for the work that detailers and electricians had to do in the field to design and install the conduit runs.

The second trial was the actual job itself, and the constraints of the design task and the time allotted for making the 3D model on top of that drastically changed the scope and nature of the project. The 2D design was most curtail and since the building increased in size, the design became larger. To save time and labor, we dismissed the 3D power devises in the walls and their connecting conduits (this was very sensible because we later redesigned the power layout from conduit to MC cable). We still retained the reflected ceiling plan lights because we needed to measure interstitial clearances for the mezzanine with them laid in. We concentrated the 3D effort on five areas: the outside area involving power from PG&E and the emergency generator into the electri cal room; the arrangement of the transformers, MSB, automatic transfer switch (ATS), and other panels in the electrical room; the various panel locations in the hallways and the underground conduit running through underground trenches out to them; the lights with their varying elevations-especially those under the mezzanine; and the Motor Control Center on the mezzanine with conduits threading through the maze of HVAC equipment to the motor disconnects.

Construction of the equipment was simple. Installing it was not. My first challenge was arranging the devises in the electrical room to match the single line diagram given the space constraint and the location of the conduits coming into the building. The second was the arrangement of the underground conduits. These were from 2" to 3" in diameter, and we had a strict 6" vertical spacing to keep: size mattered so we couldn't just leave it at using 3Dpolylines. We had to make actual conduit diameters as well as precisely minding our elevations to start and end our conduits at exact heights. Extruding conduit from 3Dpolylines is very time consuming. Fortunately we found a company called CONTEXT CAD, Inc. in Sausalito, CA. whose software did just that and cut our labor time in half. We used the same product to run out the conduit on the mezzanine.

We easily placed the lights to the reflected ceiling plan where we could and inserted the strip lights, downlights and other lights at their appropriate elevations. Our biggest problem was the size of the light blocks. I xrefed one fixture of each type into the drawing, copied it, and thereby helped reduce the drawing size. Again, I had to pay strict attention to the elevations. Later revisions required me to rearrange the lights again to allow for the HVAC penetrations.

While the model process in the Sequus project was a large success ("Into The Fourth Dimension"; Staub, Fischer, and Spradlin; CIVIL ENGINEERING, May,'99 p.44), it didn't allow for us to design directly on it and extract 2D information from it. Because of its nature, the electrical design process, with today's technology still flows much faster on paper: placing a receptacle in a virtual wall instead of on a piece of paper takes time. As yet, there isn't a way to directly use the 3D electrical model in the construction process, but that is a present technicality. I imagine that the future of modeling in the electrical design-build industry holds a lot of possibilities.

Power and lighting vendors could render the modeling a great service if they, as a service to their engineering customers, would prepackage 3D libraries (using all the popular modeling software)of "instances" (3D solid blocks or cells)of their fixtures or devises that they sell. Each instance of which would contain attributes of that fixture or device. This would cut our prep time down and allow us to extract information off the model for fixture schedules and estimations. To go the extra mile, vendors could customize the instances to the engineer's standards. The perennial annoyance of constant revisions by architects within the unyielding stricture of a deadline may be alleviated in the future by parametrically tying the electrical design to the architectural model. As the plan changes (room area expands or contracts; walls lengthen or disappear) the fixtures or devises constrained to them would alter to keep the desired required parameters. For all I know, Parametric Technologies might be working on this now.

Allowing for the time to construct a full electrical model after the final design, the model could offer detailers and electricians a valuable template if we could bring it into the field. With future improvements in "personal" computers, we could design them into rugged, portable equipment that electricians could "wear" onto the job site. A "heads up" visor could give the electrician(s) a virtual overlay of the model onto the floor of the building while yet under construction. Presumably, we would also develop very user friendly software that would allow the foreman to interact with the design to see where the receptacles, switches and data outlets all go and what circuits they run to. It may also allow him to correct the model to reflect the actual work done, and the model would become the drawing of record.

I desire a new way to do modeling. Modeling software today is truly remarkable, but it isn't the model so much that I want to improve upon so much as it is the way I view it. I am so frustrated viewing a three dimensional object on a two dimensional plane. Perhaps it's okay for watching television, but when I model, I want to discern the depth of my work. Using orthogonal breakouts on my computer screen drives me nuts when I'm trying to discern how far my conduit is from a wall- especially if I'm in a wireframe model. I concur with Dr. Issa (white paper for Stanford CEM conference "VIRTUAL REALITY: A SOLUTION TO SEAMLESS TECHNOLOGY INTEGRATION AND THE AEC INDUSTRY"). I want to be "immersed" in my work. Besides depth discrimination, I want real time pan, zoom, and fly around. I don't want to wait while my AutoCAD regenerates to give me another look angle. These aren't tall orders; they're present technology.

Several products now have what I need. ELSA makes a graphics card that will give real time pan, zoom, and fly around. Prices ranges vary, but it is a modest investment to improve the quality of model making. Two companies make "immersion" vision software and hardware. Stereo Graphics Corp. of San Rafael, CA. makes polarized eyewear synchronously matched to the fluctuating polarized shift of the monitor screen (at about 120 cps). Another company, VIRTUAL i-O of Seattle, WA. produces glasses that displays a dual VGA image to the wearer- sans monitor. You can even get earphones with them.

Soon, I can picture myself in a "holo-deck". the only furniture is a chair and an empty table. For my own comfort, I may sit on the chair, but I'm not stuck there. The table is for reference only. Wearing my 3D viewer, I can shrink or expand the image to what ever scale I wish, and either picture the model on the table or picture me in the model. The kicker is that I'm video conferencing with someone else who is viewing the same model over the internet.

These are my experiences and ideas regarding electrical modeling. Yes, I'm presuming on seamless software, and I know that we'll need an electrical entomologist to work out all the bugs, but it's all doable! Anyway, that's my dream sheet.