



takes and flaws." Hilton regularly uses renderings and animations to show the effects proposed buildings will have on their surroundings. He says in the hilly San Francisco Bay area, homeowners are often concerned their view will be obstructed by new housing developments built further down the hill. Hilton's visualizations show these homeowners how new developments will affect them. And, he adds, "there are laws in downtown San Francisco that regulate how much shadow can be cast by new buildings on open spaces. So, shadow studies are very important in the Bay area."

To show how the glass-roofed Indianapolis Artsgarden would link the city's new Circle Centre urban shopping mall with its surroundings—which include hotels, a convention center, and the Indiana state capitol complex—David Maloney of Super Sky Products, a contractor and designer of skylights and glass roofs, used Intergraph's ModelView to incorporate three images. They include the architects' rendered model of the Artsgarden, the surrounding cityscape, and a sky background.

Visualizing architectural drawings serves several purposes, he adds. "The visualizations show the architect we understand what the finished project will look like." He uses Intergraph's EMS CAD/CAM software to first create wireframes of architects' de-

signs. He then uses customized software to develop estimates of projects. Visualization with ModelView comes after his company has been selected for the job.

Maloney says he catches a number of design errors before construction begins—when they are easier, faster, and cheaper to fix. Sometimes, he creates animations to show problem areas. In the case of a new indoor amusement park at Las Vegas' Circus Circus Hotel, a problem came to light when his animation tied together the entire project. It showed that there was a clearance problem between the roof, its supporting structures, and the height of the roller coaster—the roof was too low. Design changes fixed the problem before any construction began.

### Future Trends

There is a new breed of architectural CAD software that allows architects to visualize as they design. Alias/Wavefront's ArcVision takes photorealism a step further by allowing users to create key-frame animations. Key-framing techniques let architects define a few positions for the animation. To animate a house, for example, the starting frame might be the front door, another frame at the entrance to the kitchen, and an ending frame out on the back deck. The software creates every frame in between the key frames to produce a smooth

**Perfect fit.** Super Sky Products rendered this image of Indianapolis' Artsgarden with Intergraph's ModelView software.

path of travel through the house.

In 3D modeling, Bentley Systems is introducing its new architectural modeling software, MicroStation Triforma. The new MicroStation-based product features 3D conceptual modeling as well as automatic generation of drawings, specifications, and cost estimates. For more information about Triforma, turn to *Product Focus* starting on page 26.

Another architectural 3D modeler is a German import called Speedikon that offers both AutoCAD and MicroStation interfaces. While plans are being drawn in 2D, Speedikon creates an intelligent 3D building model. In addition, all construction documentation, including floor plans, sections, elevations, material, and quantity take-offs, are derived automatically from the 3D building model.

Bechtel Corp., an international architecture, engineering, and construction firm, currently uses Speedikon, as well as a host of other CAD/CAM technologies in its design and construction of a 24,000-ft concourse at the Dubai Airport in the United Arab Emirates. Larry Haines, chief architect in Bechtel's San Francisco office says, "Visualization enhances communication between clients and architects. With it, we can make buildings closer to what the clients want."

Haines adds that at Bechtel visualization usually starts when its projects are nearly 5% to 10% complete. To further this effort, Bechtel is branching out into virtual reality (VR). Its VR department is using a virtual reality system from Division Inc. to review the design of the Dubai Airport expansion as it develops. The system allows engineers to use a larger database than was previously possible, enabling them to walk through the entire project, import texture maps and CAD data, and use one key stroke to change the environment for different lighting and weather conditions. The most important advantage of using VR, Haines says, is the ability to make design changes faster and easier so that the architects are willing to consider more alternatives than ever before.

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