Seeing is believing

Virtual reality can save you money


Kevin McGuinness


Stephen Bauld

HISTORICALLY, PUBLIC CONSTRUCTION has suffered from serious cost over-runs and completion delays due to late term design changes. During the construction phase, hidden problems, not identified during the design consultation process often occur. It has been difficult to create a true picture of a project before it is built – to see if a particular design approach is not just feasible, but optimal.

Virtual reality, or modeling and simulation, can help.

Construction is information-intensive. As project scale increases, the number of documents increases geometrically. On large projects, the volume of information can become excessive even for seasoned construction veterans. Construction projects must often serve diverse constituencies, all of which must collaborate in the design process. Unfortunately, these individuals often have little experience in construction and less ability to work with design tools such as architectural drawings. Even scale models may be misleading, because actual adjacencies and distances are misleading in the context of a small model. The result is that there are significant barriers to communication between design professionals and contractors, on the one hand, and eventual users, on the other.

The solution may well be found in what initially seems a most unlikely source: the world of computer gaming. Recent research suggests that design-simulation software utilizing virtual reality technology (VR) can generate significant reductions in construction costs, by permitting people to see how a building will look and operate before it is built. As a side benefit, the finished product is also likely to be far more ergonomic. In the United States, the federal government is now employing this technology for federal courthouse design.

Traditional two-dimensional architectural plans show only aerial or planar information. Eventual spatial characteristics are at best implicit and can only be appreciated if plans are provided in a series. In contrast, computer-aided 3D visualization techniques allow spatial concepts to be conveyed in an easily understandable form. VR allows prospective users of a building to work interactively with proposed designs, by converting 3D building plans into a computer program that operates more or less in the same manner as a computer game. In this way, project information is presented in visual form rather than in text and drawings.

VR simulates aspects of the projected work environment early in the design and project scheduling stages, including traffic flow, lighting conditions within the facility, its acoustics, and the steps required to carry on routine work. Users can "walk through" the project, and get a clear, practical understanding of what the plans will ultimately generate in terms of a real world building. Even furniture and other workers can be built into the simulation. In this way, possible problems with the design can be identified, and feedback from users can go into the design process. In addition, designers can themselves better assess the impact of design changes in one area on other areas of the project.

Briefly, here is how the process works: Spatial layouts are developed from the structured building program. These represent conceptual sketches of the building form, developed in a 3D-modelling environment. As these models are developed from the building program, it is possible to assess the match between clients' requirements and preferences, and the conceptual design. "What if" simulations can be run to assess the benefit and detriment of optional approaches. As the plans become more detailed and refined, computer aided design (CAD) applications permit even more fine tuning.

More sophisticated modeling permits the cost implications of changes to be assessed in advance. Proposals can be submitted to extreme working conditions. For instance, for secure facilities it is even possible to program in the implications of a terrorist attack or critical event, such as a major building fire, so that survivability can be better assessed. In hospital design (where controlling the spread of infection is of obvious importance), VR can be used to simulate the flow of airborne particles and other contaminants. While traditional plans offer users at best a rough idea of how a building will work, VR systems can be used to investigate operations in subtle and multifaceted detail.

An added benefit of using VR is that the design process can become more of a collaborative effort, involving the design and building contractors, the owner's procurement team in charge of supervising the project, their consultants, and the eventual users who will have to make use of the facility. Key individual decision makers who may not be available for a meeting can use the technology to work through design ideas at a time that is convenient to them.

Although this technology has been available for a decade, it has been slow and costly to use. However, recent developments have linked the process with standard architectural design programs, drastically reducing both cost and the time required to generate working models. Even so, VR is most likely not suited to small construction projects. But, where an owner is contemplating a major construction project – where the possibility of late term design changes presents a serious risk – it is worthwhile to discuss with design professionals using VR as a cost saving option.

Steve Bauld spent many years as purchasing manager at the City of Hamilton and is now vice president of the Ontario General Contractors Association. Kevin McGuinness is a lawyer with Ontario's Attorney General. Together they have collaborated on several books about procurement and leadership.