Software Introduction

The market for the civil engineering equivalent of the Building Information Model, the road "information model", now looks set to develop

The virtual model, built within a computer before going on site, is finally becoming a reality for checking, verification, planning and consultation with public, clients and contractors. According to Mike Williams, chief information officer at major US consultant Parsons Brinckerhoff, the information model is at "...a watershed moment in its adoption."

For various reasons, not least the legal requirement for 2D drawings as the document of record, civil construction has lagged. The large linear scope of road and rail for example, and the individuality of construction has made information needs different. Existing software has already been partly in 3D anyway, with the terrain models and surfaces used in the mainstream road applications like Bentley System's products, be they Inroads, Geopak or MX. But now new techniques to bring in survey data, on a geographic scale, with lidar, GPS and automated total station techniques combined with massively enhanced capacities of computer processors and bulk memory storage, are opening up new possibilities.

The Revit type of program, which builds up such models using 'intelligent components' rather than lines or even just shapes, has been at the forefront. Revit is widely used in architecture where elements in a design 'know' their properties and adapt to the components around them. That allows information on materials to be extracted for walls, floors and so on, and the hundreds of fittings and furnishings making up a building. Drawings are either automatically generated or bypassed altogether for construction.

Similar civil parametric programs like Civil 3D from Autodesk are growing in capacity by leaps and bounds. Its ability to rework the entire design if a change is made to one part, like the alignment or the cross section, is crucial. Other programs like Novapoint in Scandinavia or Sierrasoft's road suite in Italy have also been developing this approach, the former for almost two decades.

What these do is to bring in the self-adjusting and "intelligent component" approach. Civil 3D also links into the structural capacity of sister program Revit, which for the first time in its 2010 version, has a separate edition for civil structures as opposed to the architectural emphasis of the original (see Dublin example).

The capacity to integrate complex structural elements into the road, is tackled head on by Bentley Systems which is developing its own concept of the

Advanced visualisation and modelling tools make construction projects easier to manage

"Bridge Information Model", linking powerful analytical and structural design software tools for bridges to the road tools. There is interoperability between the different applications inbuilt into its range, which it declares is still the widest set of tools offered. Bentley will also interconnect with a wider range of outside files and under agreement even includes Autodesk software libraries these days to ensure generating AutoCAD files is as accurate as possible. AutoCAD can equally generate MicroStation files.

Interoperability is a major aspect in the developing use of 3D models, said Williams, as is the bringing together of different 3D model components in one place so that they can be seen alongside each other. Autodesk's Navisworks does this for example and is a critical tool for spotting clashes. Bentley's Projectwise Navigator will do the same, though it tends to be happiest in a complete Bentley set up.

Various components of a road such as drainage, or electrical lighting cables, or water pipes, increasingly produced as 3D designs themselves, can be assembled with a mass of information attached to each component, stored in ever more flexible and high capacity database systems. Novapoint's Virtual Reality module does this too. Matching information from multiple elements of a project allows project planning and costing to be attached in further "dimensions" (see Presidium article).

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Alongside, visualisation becomes much easier and of higher quality, for both public and client consultation and for the designers themselves to better grasp complex projects. Even engineers can have trouble imagining the actual result from drawings alone. Rendering tools are growing in sophistication. The industry mainstay 3DS Max from Autodesk for creating visualisations adds newer and more complex rendering ability.

But this is now being challenged by Bentley Systems, which has built a high grade visualisation capacity into its latest version of Microstation, its core CAD platform. An embedded Luxology rendering 'engine' produces exceptional photorealistic results from the models developed, with a range of lighting effects and weather effects included, realistic shiny and metallic surfaces and generated grass and such textures. Bentley claims that it is better than the competition and although that is subjective, the package can render very fast straight from the design model using multi-core and/or 64 bit processors. It will also manage several linked computers as a 'render farm' to speed the result. Engineers almost instantly visualise at different levels from monochrome to fairly well shadowed coloured image, and check each time a design is iterated for improvement.

There is conceivably a medium term prospect of designers working in such realistic models directly, believes Alvise Simondetti visualisation project leader at consultant Arup, so that visualisation is not just a one way tool but part of the whole design process. It will still be important, and perhaps easier, to understand the underlying design tools. ■

Autodesk
www.autodesk.com

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Novapoint
www.novapoint.com

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