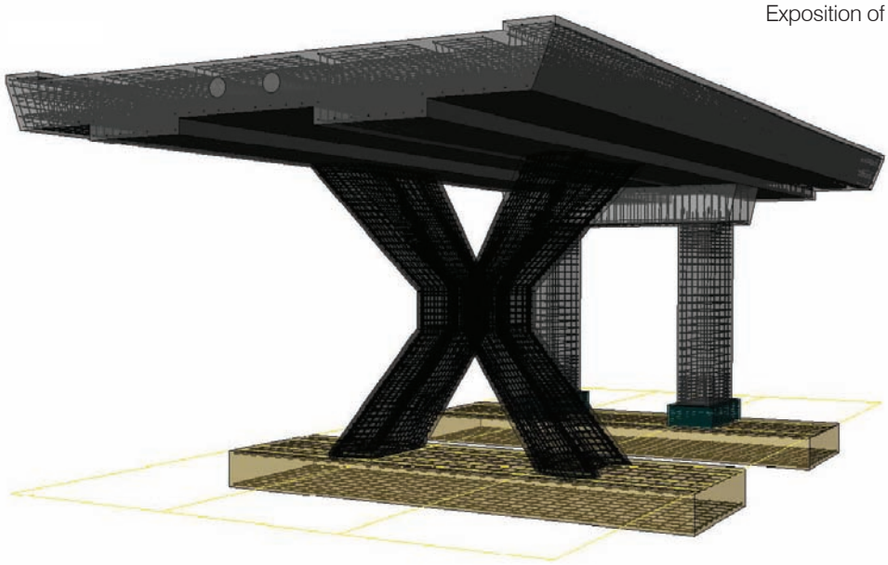
Written in concrete

Bentley Systems' ProConcrete V8i brings an ancient material into the 21st century, says David Chadwick

Although the history of concrete goes back to the Assyrians and Babylonians, who used clay as a bonding substance or cement, and the Egyptians, who used lime and gypsum to produce cement (and some of whose buildings are still standing!) it wasn't until 1756 that a British engineer named John Smeaton made the first modern concrete (hydraulic cement) by adding pebbles as a coarse aggregate and mixing powered brick into the cement. Smeaton was followed in 1824 by English inventor Joseph Aspdin, who invented Portland Cement - now the dominant cement used in concrete production - by burning ground limestone and clay together, changing the chemical properties of the materials and creating a stronger cement than that produced by plain crushed limestone.

Reinforced concrete was invented in 1864 by Joseph Monier, a Parisian gardener who made garden pots and tubs of concrete reinforced with an iron mesh. Reinforced concrete combines the tensile or bendable strength of metal and the compressional strength of concrete to withstand heavy loads. Monier exhibited his invention at the Paris Exposition of 1867. Besides his pots and tubs, he promoted reinforced concrete for use in railway ties, pipes, floors, arches, and bridges. It is fair to say that without it, many of today's buildings would have been impossible to build.



WORLD OF CONCRETE

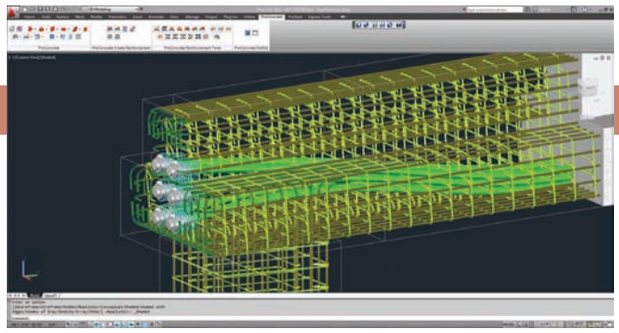
Despite the above it is, I suppose, still a bit of a Cinderella industry, the prosaic nature of the stuff hardly being thought of in today's exciting world of structural design and analysis. But the demands and the possibilities of using the latest techniques in the creation of reinforced and precast concrete structures warrant just as much attention as the rest of the industry. Therefore, and most appropriately one would suggest, the construction industry has its own conference dedicated to the hard stuff - in Las Vegas of all places! - called the 'World of Concrete'. It was there that Bentley Systems won the prestigious 'Experts Choice' award in the 'Business Tools and Software' category for its ProConcrete software for advanced 3D modelling, detailing and scheduling of concrete structures.

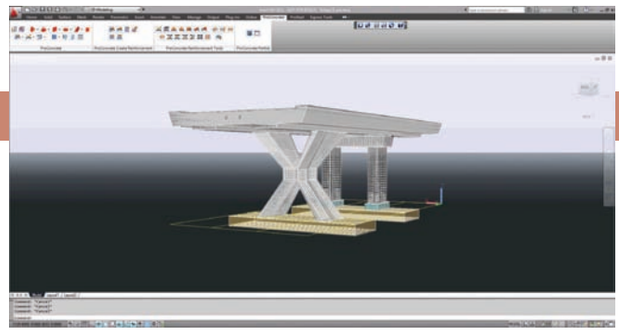
PROCONCRETE

ProConcrete, developed jointly by aSa, the world's leading rebar software provider, and Bentley Systems, is used to automate the production of designs of reinforced concrete structures, modelling all of the components of a structure - including concrete, rebar, mesh and connectors - and handling cast-in-place as well as precast concrete elements.

It uses parametric tools to build any type of concrete structure, with real-time 3D visualisation and automated drawing documentation production of concrete structures. It also enables full bills of material and reinforcement schedules to be extracted, providing information for project costing and estimation.

ProConcrete's multi-material modeller





enables the engineer to lay out complex structures, produce design drawings, detail pre-cast drawings and bar bending schedules simply and intuitively with the click of a mouse. It can also be used to assemble bar-bending layouts - the automation of which helps to eliminate errors and design flaws and dramatically speed up the production of associated BOMs and construction documentation.

Developed by engineers steeped in the reinforced concrete industry, the software enables structural and civil engineers to plan, design and assemble concrete structures in a wide variety of applications - commercial, residential, industrial, stadiums, civil works, retaining walls, culverts and bridges.

A wealth of standards, building codes, materials and construction techniques are built into the software, using easy to edit Microsoft Excel tables or Access, with all standards - bar bending, laps, development length and values - based on regional codes, although users can develop their own codes if desired. They can also customise their own drawings styles using special templates. Consideration has also been given to the way in which concrete structures are used in buildings, such as multiple cages in elements and the use of multiple hinge zones for beams.

In most projects, reinforced concrete is used in conjunction with steel structures. Accordingly, ProConcrete V8i works with Bentley Systems ProSteel V8i, the 3D modelling environment for structural steel and metal work, to design and document composite structures using a single integrated tool. Both of the applications are available together under the Bentley ProStructures product suite.

INTEROPERABILITY

ProConcrete V8i is compatible with AutoCAD and is, of course, available on the Microstation V8i platform, providing total interoperability between the two systems, with ProConcrete able to import and export from the AutoCAD environment to Microstation V8i and back using its Integrated Structural Model (ISM) intelligent file format, and also to share data with other 3D modellers; Revit, StAAD and RAM. This enables users to, for instance, change the dimensions of a concrete slab in a Revit model and have it automatically updated in the corresponding ProConcrete model. Alternatively, you can draw a 2D 'T' shape in AutoCAD or Microstation and use the shape for ProConcrete generated beams and columns.

DID I SAY SIMPLE TO USE?

ProConcrete is *extremely* easy to use! Engineers enter basic information about the required structure - its length, width, height, number of floors and distance between gridlines - then click on a point on the drawing. A 'work frame' is automatically produced - a 3D wireframe view of floors and grids. This can be edited to produce more complex structures, incorporating shapes and boundaries using 2D polygons, and then incorporating them into the 3D work frame.

Once the dimensions have been used to concrete one work frame, they can be used to define the members on all floors, beams, columns, footings and walls, if they are similar, in a few seconds by checking the appropriate boxes in the Work Frame tool. Alternatively, dimensions can be defined for individual elements which can then be placed in the structure by placing them on points, gridline intersections or drawn paths.

Reinforcements are added to the concrete by setting up clearance, spacing, lap and hook parameters, and then placing the bars inside the concrete shapes. Being parametric, changing concrete dimensions forces similar changes to the associated reinforcement.

Besides providing tools for the creation of beams columns, etc., ProConcrete includes utilities for editing single bars and runs of bars, giving engineers precise control of some structural elements and, where bars from different concrete objects overlap, 'joggle' tools can be used to automatically create offsets and shift bars.

DRAWING FROM PROCONCRETE

ProConcrete can be used to generate all 2D rebar placement drawings, bar bending schedules and parts lists. It's very straightforward. On the 3D model, in any view, a box is drawn round the area of detail to be included in the 2D drawing, and ProConcrete's Detail Manager automatically generates the 2D drawing for you. No need to mechanically produce drawings from a number of elevations. Detailing styles can be set up to modify the appearance of the 2D drawings, with numerous options for handling title blocks and scaling drawings on the printed sheets.

Similarly, schedules, reports and material take-offs are as easily produced, and can be output as PDF, RTF or HTML files.

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