Get Smart: Intelligent 3D engineering models enable comprehensive lifecycle information management

Bentley Systems' **Shaun Severin**, a water treatment plant design expert, shares insights on the demands and directions of the evolving discipline of intelligent 3D modeling in an interview with *World Water.*

The complexity of water and wastewater treatment plant design requires a geographically diverse, multi-disciplined team involving collaboration across consulting firms, contractors, and owners. The steady transition to 3D and intelligent, multi-discipline models is empowering organizations to capitalize on the use of digital engineering models to achieve data integrity and continuous infor-mation flow throughout the operational life of these assets.

In an interview with *World Water,* Plant Design Engineer Shaun Severin of Bentley Systems discusses these developments, applications of intelligent 3D models, and their benefits.

World Water _____ What is driving the demand for scalable and open 3D design models?

Shaun Severin _____ There is growing emphasis on applications that can plan, design, operate, and maintain water and wastewater treatment infrastructure more intelligently, specifically applications that include support for electrical, mechanical equipment, mechanical and structural piping, supports and hangers, HVAC, structural steel, and reinforced concrete. Open data models simplify data sharing and expedite projects because existing designs, models, and associated data and catalogs can be reused. Ultimately, the efficiencies established in a successful design process should result in intelligent digital engineering models that allow information to be preserved, augmented, and validated from preliminary design through successive lifecycle stages. This results in lower risk, improved asset performance, and reduced costs. Decreases in design and construction costs through greater engineering efficiencies should be enabled by clash detection, design review, cost estimation, online vendor equipment, a piping and electrical components catalog, material management, and construction planning, sequencing, and monitoring.

And, yes, we find that open data standards accommodate standard data formats and integrity so that these digital engineering models retain their integrity into the handover process – a critical factor for a treatment plant since handover demands absolute engineering accuracy. This detailed information becomes the driver of a highly intelligent, consistently accurate model that supports excellence in form, function, and output during the entire operating life of a water or wastewater treatment plant.

WW _____ Have measurable benefits been achieved to the degree that an industry best practice has emerged for these "intelligent" design projects?

SS _____ In order to capitalize on the value of digital engineering models, users have determined by consensus that their plant design and analysis solution must have several vital capabilities. Through their successful project implemen-tations, users have proven that intelligent modeling is effective, not only from preliminary design through construction and oper-ations, but also as a way to retro-fit designs, to visualize facility configurations, and to streamline workflows. Here are the system capabilities that are mandatory
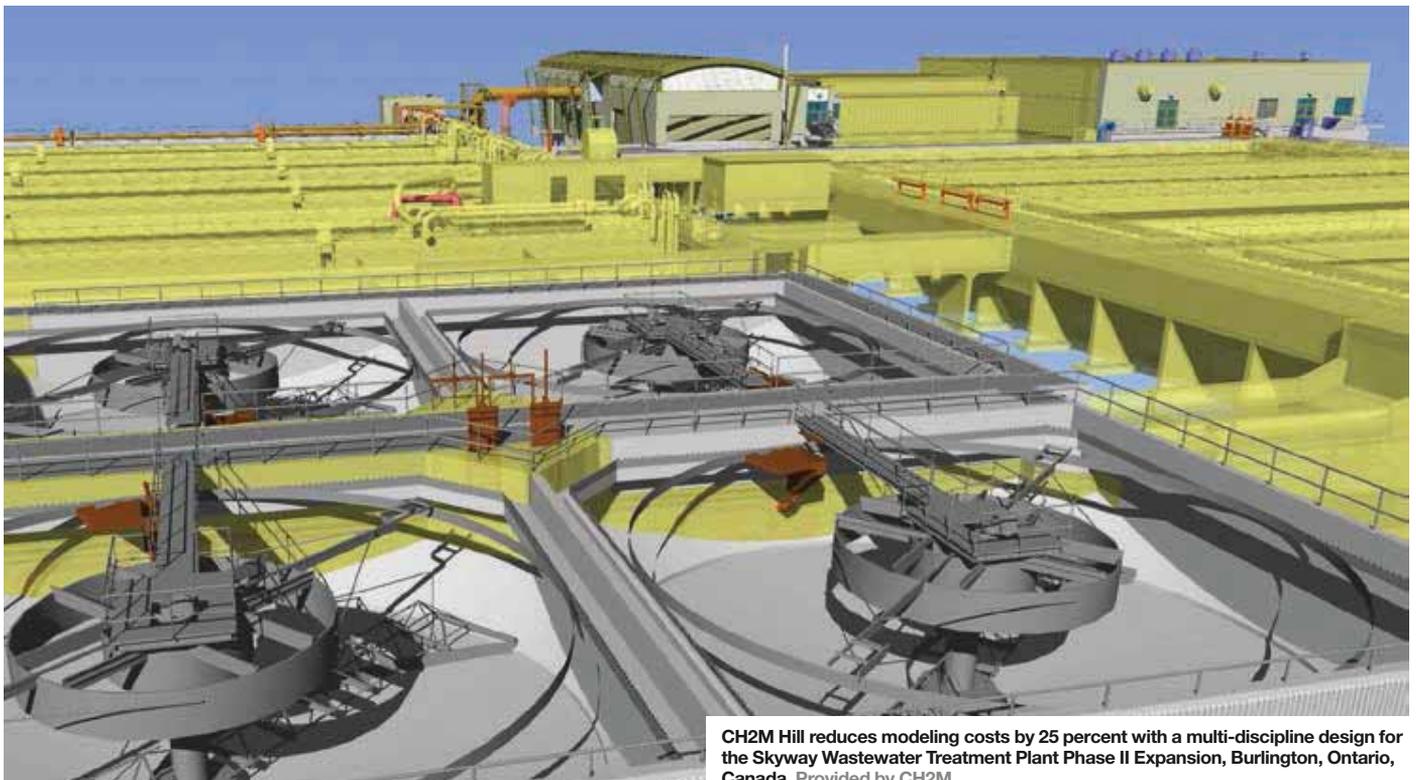
CH2M Hill reduces modeling costs by 25 percent with a multi-discipline design for the Skyway Wastewater Treatment Plant Phase II Expansion, Burlington, Ontario, Canada. Provided by CH2M

for successful results:

- *Multi-discipline plant design:* This feature represents the ability to integrate plant design disciplines to produce high integrity multi-discipline plant models and utilize interactive 3D design for civil, structural, mechanical equipment, piping electrical raceway, and HVAC plant systems. Combining physical plant design with schematic design allows for the comparison of 2D and 3D plant models. The model facilitates the production of detailed material take-off reports for all plant commodities.

- *3D interference analysis:* This capability increases accuracy with automatic clash detection across 3D piping, structure, equipment, electrical, and HVAC.

- *Plant electrical systems design:* Intelligent schematics increase the speed and quality of plant electrical systems design. A 3D electrical layout can be performed against a 3D plant model referenced from common plant design applications.

- *Plant instrumentation systems design:* This feature involves design and model plant instrumentation systems integrated with piping and mechanical process equipment designs. It also utilizes schematic data during design for in-line instrumentation devices.

- *P&ID deliverables generation:* This capability ensures rapid creation of intelligent piping and instrumentation diagrams (P&IDs) with components verified against project piping specifications. It allows for generating reports with critical project information including valve, line, and equipment lists that can be exported to Microsoft Excel or connected to a plant project database for project-wide reporting.

- *Intelligent isometric production:* This feature enables extraction of isometrics from multiple 3D sources and automatically produces isometrics. Tagged component information contained within the isometrics may be linked to asset information systems so that rich engineering data is available over the complete project lifecycle.

WW _____ Are you seeing economic metrics that support these system demands?
SS: To cite a specific example, Bentley's Promis.e application was deployed for the electrical design of an automated water quality monitoring and control system as part of a project to redirect the water supply of Khabarovsk,

Russia, to an underground source. The application enabled the project developer to store all project data in a connected data environment to provide all relevant professionals access to the latest documentation and facilitated selection of the best possible water quality monitoring equipment. The outcome was that design work was completed 50 percent faster, documentation quality was 70 percent greater, errors were limited, project costs shrank, and the workflow process was economical and simplified.

WW _____ We have been hearing a lot about intelligent P&IDs providing an index for managing tags in the facility and across applications. Can you elaborate?
SS _____ Advanced applications make it possible to design and model plant instrumentation systems that are integrated with piping and mechanical process equipment designs. These applications also expedite designs with accurate 3D models of raceways, duct banks, and cable trenches. Additionally, structural disciplines can take advantage of intelligent modeling for precise detailing of reinforced concrete, metal work, and steel structural projects. Any change in a 3D model

can trigger an automatic update of design drawings, documentation, schedules, and fabrication details. The 3D model also takes automatic receipt of any 2D drawings. Even for plant upgrades and retrofits, there is a need to reuse legacy P&ID drawings, to create intelligent P&IDs for managing tags in the facility, and to use reality modeling with point clouds and photographs to capture existing plant conditions.

WW _____ What about modeling structural components?
SS _____ In intelligent design applications, the types of structural components that can be modeled are not limited. These structural components include beams, columns, braces, slabs, walls, footings, rebar, stairs, circular stairs, handrails, ladders, steel connections, and foundations. Drawing capabilities include steel fabrication and rebar placing drawings that can be tailored to user standards. As an example, Southern Water took this approach when it needed to incorporate front-end engineering services as a core component of its plan to provide more efficient water and wastewater treatment service to four jurisdictions in southeastern

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