Taking the digital toolkit to the next level

As one of the leading software providers into the water industry, Bentley Systems is at the heart of the digital revolution for water. GWI talks to Gregg Herrin about how digital twins and AI can drive the sector forward.

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Gregg Herrin
Vice President, Water

Gregg Herrin is Vice President, Water, where he leads the team responsible for Bentley's hydraulics and hydrology applications. He joined Bentley in 2004 when Bentley acquired Haestad Methods, a pioneer in the hydraulics and hydrology software industry. He has served in a variety of roles focused on the combination of engineering technologies and data systems.

What are the key drivers of your water technology strategy?

Although we are a software provider, we are really looking at this from the perspective of outcomes rather than the tools. The outcomes are, for example, to have a safer drinking water network, a more efficient treatment plant, or to prevent and identify leaks. We use our engineering expertise and our software expertise to build tools with those outcomes in mind, but openness is also an important part of this. There is a whole ecosystem of tools out there and we make sure that our users can be successful with the tools and data they already have, as well as the Bentley pieces that fit into that. A deep vision for the open standards and interoperability and integrating external data sources is a key part of what Bentley has stood for and continues to do so.

What technologies are the key subjects of your R&D?

We have our traditional engineering tools for planning and design and we're certainly continuing to make those tools sharper. There is constant work on software solutions like hydraulic simulations, the functional design of the hydraulics of piping networks and then the physical designs of how you put assets into the ground.

We're now increasingly focusing on integrating engineering technology with information technology such as GIS or operational technologies like IoT devices and SCADA systems. This integration allows us to obtain extensive data. By combining this data with tools like AI and machine learning, we can identify patterns much faster than a human can. Additionally, these tools help us evaluate various options for addressing the identified issues.

How do you most effectively apply digital twins in the water sector?

At the individual facility level, a digital twin is beneficial for tasks like guiding a maintenance person, for example, where to locate a specific pump that they need to service. However, we're finding more value in scaling up to the size of a city to show the context that a treatment plant is operating in. For example, where it is getting its raw water or how water is being pumped through the network. The digital twin works at that scale as well. You can even take it a step further and see how the water network is connected to the electrical grid or determine when to dig up a street depending on road conditions.

People often start with that longer term vision of connecting everything but choose one pressure zone or one facility at a time to work on. As they get something online, they move to the next asset and so on. Before you know it, they might have half their city mapped out.

What key benefits do your products offer water and wastewater systems?

Part of what we can do with the technology is to start making engineering information, which has a lot of value in it, much less isolated to the engineering team. It can be exposed in a way that is consumable by other teams. That's really what we should be striving for across the industry: a case where a customer service person might get a complaint about low pressure and ask engineers if that's expected to be the case. Or is it indicative of a problem that hasn't been caught yet? That can then be escalated up to a maintenance crew, which can start with basic information about how the network is pieced together and the cause of the problem.

Sabesp in Brazil for example, rolled out digital twins across various targeted sites in São Paulo, and that already is paying dividends with not only their customer service teams, but their maintenance teams are able to make decisions and respond to events faster. Within seven months, Sabesp saved BRL3.1 million ($540,000) in corrective maintenance, achieving a 30% reduction in corrective services to save 2,800 hours in field work.

How has digital technology developed to assist in the path to net zero? Could you name an example of where you have contributed to this initiative?

Firstly, we have to recognise that energy is always going to be an integral part of a water utility or wastewater utility's operations given their mission to supply clean drinking water and treat wastewater to return to the environment. If we look across the life cycle, we have tools that look at the carbon footprint of treatment assets as we build them. If we know what materials are being used, we can assess the associated impacts of those materials and determine if we've chosen those materials wisely.

Looking beyond the construction phase, we also then need to determine, for example, whether a pump is using energy to push water around in an efficient manner. We can do scenario evaluations to see if pumping strategies may need to be changed. Evides, the utility responsible for Rotterdam and the surrounding area in the Netherlands, went through a lot of different pumping scenarios and were able to optimise their system in Kralingen, reducing pumping costs by about a third as well as their carbon footprint by 942 tonnes $CO2$ a year.

In some cases, we could even look at having to avoid pumping water. There are scenarios we've written of in the past around connecting different parts of a system by gravity. There might be a higher initial cost to dig a cross-country pipeline to connect it, but we won't have to use pumps. We're really taking a broader look at the longer-term value of everything in the context of carbon.

In your opinion, what are the biggest challenges faced by the wastewater treatment sector?

The biggest challenge I see is that people don't see wastewater as an attractive career. The infrastructure is getting older but fewer engineers are interested in pursuing it. But technology can help here. If wastewater treatment workers are able to monitor wastewater treatment facilities virtually, through digitalisation, it allows them to work more efficiently and spend less time onsite at treatment facilities where more hands-on work would be necessary. This is needed because ageing infrastructure and increasing regulatory pressures combined with the turnover of staff, due to people retiring and it being a less attractive career, means that the people who are serving this industry are going to need better tools at their fingertips to be able to do it.

AI comes into play here because it can offer additional support and insights that staff may not be directly able to see. For example, the concept of a co-pilot that can answer simple questions by returning information about the regulations or the design criteria or things like that. Also, it could automate some aspects of designing a new treatment plant or pumping station.

If staff have more time to focus on decision making and evaluate their different options at a distance from actual wastewater facilities, this can help make a career in wastewater more attractive.

CALIFORNIA SAVINGS

EchoWater was completed $400 million under budget, saving taxpayers more than half a billion dollars.

Source: Project Control Cubed

Which of your recent product developments have gained most uptake in the water industry and why is that?

2D modelling of what's happening with flooding and sewers is seeing a lot of interest. The traditional view on sewer design is that it shouldn't surcharge but there's more interest now in saying that while it shouldn't, it might, and therefore a client wants to understand the impacts of a potential surcharge.

The other thing that we're seeing is a lot more of that intent to connect the dots between the different infrastructure lifecycle points; carrying details from design into construction and then from construction into operations. For example, at the Echowater project in California, they were adding a tertiary treatment plant to existing infrastructure, but by recognising the value in the design that can carry into construction they digitally rehearsed how the construction site is going to work, so they could catch mistakes or find those tight coordination spots ahead of time. That project saved hundreds of millions of dollars on the that project that got reinvested into another water resources project.

What do you think will be the game-changing technologies in the water sector in the next ten years? What is ripe for disruption?

I think the most disruptive thing we're going to see in the water industry is actually a disruption in the mindset. The sector has traditionally been conservative to the point of taking no action, but I think there's an increasing recognition that not doing anything is a choice and it has consequences. There will be more transparency into what the outcomes are when you don't make changes.

For technology more specifically, as utilities adopt more sensors and smart meters and other data acquisition products, they will have so much data that they can't digest it all. AI comes into play here and I see it as largely sitting next to engineers, operators and maintenance teams, alerting them when things are happening and suggesting actions for them to take. Utility staff will still be making the decisions, but AI will help them evaluate options faster and find information more quickly.

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