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Digital Innovation: HNTB's Reality Mapping Evolution

BY MARC GOLDMAN

Using preliminary design from CAD/BIM, a new railroad bridge is raised out of the floodplain and integrated with existing river topography and vegetation.

For more than a century, employee-owned design firm HNTB has helped create built-world projects that meets the unique demands of its environment and community. With client relationships spanning decades, they understand infrastructure life cycles and have the perspective to solve technical challenges with clarity and imagination. HNTB takes "Reality as a Service" as a guideline, with an emphasis on accurate 3D representation as a base layer for all work—at any scale and through all project phases. At least, that's the idea; not too long ago, HNTB Digital Transformation Solutions Department Manager Darin Welch wondered if their projects were living up to that ideal. "We've been on a path trying to define what the digital world-building promise really is, what it means for us and for clients, and if we're keeping that promise," he explains.

In some ways, he had to conclude, projects were falling short of their full potential. "We captured reality for design and visualization, but we weren't truly *planning* in 3D. We also weren't leveraging 3D within our design practice to the greatest extent, using reality-mapping to study tricky areas of planning design such as hazardous or environmentally sensitive conditions, nor were we routinely overlaying community demographics or community engagement on 3D representations … Basically, we saw a lack of recognition for the value of 3D during planning and preliminary design—rather than just at the full design and construction phases," adds Welch.

It was eye opening, given that HNTB certainly has the in-house capacity to create and work with sophisticated digital models. "With the fleet of reality-capture equipment and experienced geospatial professionals nationally, we've done a lot with mobile and static LiDAR and have been using UAVs to capture reality in high fidelity for a number of years now," he adds. "We're great at gathering detailed information, even of structural elements. But we were seeing a gap between all this great reality capture and extending its value within *every* phase of a project."

Could a software solution close that gap?

ArcGIS Reality

Released in 2023, Esri's suite of reality capture and mapping tools is directly aimed at the gap between reality capture and all-scale, all-phase project use that Welch was seeing at HNTB … and that

many executives at consulting firms have noticed. ArcGIS Reality's collection of reality capture and mapping tools enable firms to:

- Map reality from aerial imagery directly to 3D mesh models.
- Generate 3D outputs directly from drones, crewed aircraft or satellite imagery.
- Apply cloud-based end-to-end reality mapping to drone imagery, simplifying drone data workflows as well as imagery data collection, processing and analysis.
- Use desktop applications that enable reality mapping from drone, aerial or satellite imagery while also having access to powerful offline processing and in-the-field rapid mapping.

This "hybrid" calculating approach—cloud, desktop and field—along with automated direct-to-mesh or true ortho efficiency makes precise and speedy digital modeling possible at essentially any scale, up to whole countries—ending the cumbersome practice of splitting up large-project data acquisitions into multiple projects or days. And as one might expect from Esri, all this high-resolution photorealistic imagery is easily aligned with survey-grade modeling and existing GIS and mapping inventories.

Put another way, ArcGIS Reality could have been created specifically to address the digital delivery data gaps and workflow shortcomings Welch was seeing. "When we saw ArcGIS Reality, it seemed like it could be the missing link to complete HNTB's digital delivery journey," he notes.

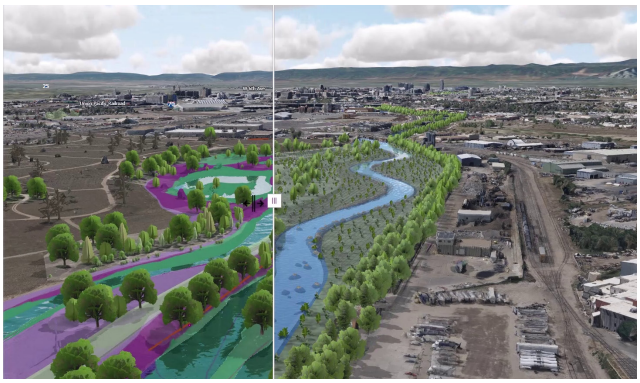
And he had just the project in mind to prove whether that was true.

Digital Mapping 6.5 Miles of River Corridor . . . For a *Proposal*

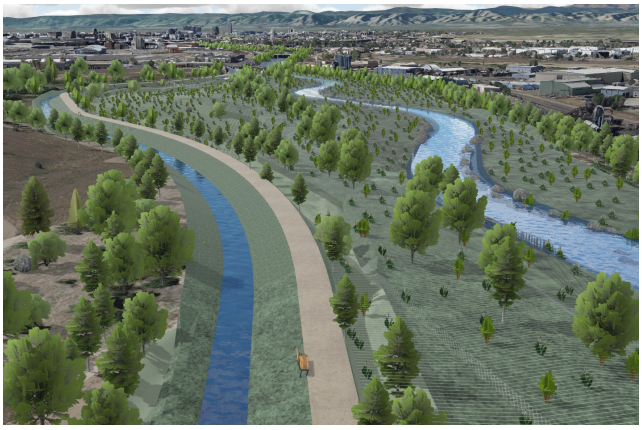
The South Platte River Project in Denver is a collaborative effort between the U.S. Army Corps of Engineers and the City & County of Denver to restore the degraded South Platte River habitat systems in Denver while improving flood resiliency. Aiming to support Denver in their One Water Vision of the "Waterway Resiliency Program" portion of this massive project, HNTB realized that digital mapping of 6.5 miles of river corridor was necessary as a proactive preliminary design, analysis and visualization platform—and not just for presentation purposes.

"Just for our own intelligence gathering, we needed to understand years of previous environmental work that had been done here, along with complex utility networks installed over decades—and we were putting this all into our enterprise GIS," explains Welch. "On top of that, we partnered with Vexcel to acquire high-resolution aerial photography and supplemental imagery of the corridor using our Skydio X2 drone. We saw an opportunity, with ArcGIS Reality, to put it all together in a GIS-enabled digital twin for our team to use, not just in the planning phase, but in the proposal phase—turned out they loved it. It made our entire team more knowledgeable even before the official project started, thus demonstrating our project team's readiness for the project right from the start."

Working directly with photorealistic, accurate-geometry 3D mesh models, HNTB's Manager of Spatial Strategy Adam Radel incorporated their GIS inventory, digitized the environmental impact statement, built a fully validated proposal, and was able to incorporate a visual comparison tool that seamlessly allowed team members to "swipe" between present conditions and proposal outcome. Radel adds "it was almost like a future as-built of the corridor."



A 3D swipe reveals an immersive and dramatic before-and-after proposed river design based on the 2018 Final Environmental Impact Statement.



World-building brings a reimagined landscape to life from lifelike trees and weathered boulders shaping the realigned river to inviting park benches and riparian habitat commitments realized.

There also was a gamification aspect to the proposal. The 3D model fidelity was planned to include the elements of subtle realism, incorporating trees and other vegetation; adding features such as transparent water and rocks in the river, and approaching full game-engine representation verging on uncanny valley (or river) representations. Radel emphasizes, "such judicious use of realism kept the proposal grounded, usable on smart phones, and made use of the nifty 'swipe' available at every point in the 6.5-mile corridor."

Long story short: HNTB is more ready than ever to deliver this incredible ecosystem restoration and water resilience program and, in doing so, proved to themselves that, with the right digital strategies, that HNTB is ready to provide "Reality as a Service" to any client, at any scale, at any project phase.

ArGIS Reality Suite combines a number of Esri offerings: Drone2Map focuses on site-scale reality mapping, while Site Scan for ArcGIS provides end-to-end cloud-based drone mapping. Reality Studio is designed for city- and countrywide mapping using aerial imagery. Additionally, Reality for ArcGIS Pro is an extension enabling users to enhance GIS workflows with reality mapping capabilities. Collectively, these solutions cover various mapping needs, from site-scale to citywide projects. For more information about ArcGIS Reality, visit *https://go.esri.com/aec-ii-reality*. II

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