GEOSPATIAL TECHNOLOGIES INFORM INFRASTRUCTURE DECISIONS

Digital twins, public transport projects, road safety plans and studies in climate change require real-time data with positional accuracy.

Geospatial technologies are essential for generating the timely, relevant and accurate data needed in infrastructure projects. This business-critical data enables detailed visualization for situational understanding and analysis—by conveying the precise location of infrastructure, its features, and how those features relate to each other. In the following Q&A, we spoke with Barry Creed, Southeast Geospatial Manager, United States, WSP, to explore the pivotal roles of geospatial experts and technologies in infrastructure projects, and in advancing efforts to meet sustainability goals.

This WSP image represents the initial creation of a digital twin model of a rail bridge, utilizing a point cloud created from a terrestrial laser scan and site imagery. The model can be used for a variety of engineering and inspection purposes throughout the project lifecycle.

What geospatial technologies are commonly used in infrastructure projects, and how do they contribute to project success?

Barry Creed: Today, geospatial teams use a range of technologies to compile data and draw conclusions from that data to benefit infrastructure projects. A combination of remote sensing, global positioning systems, traditional surveying methods, satellites, and airborne systems are the primary tools we utilize in our data collection process. Airborne systems—such as airplanes, helicopters, and unmanned aerial systems, also known as drones—are equipped with a variety of data-creating sensors, such as SAR [synthetic-aperture radar], LiDAR [light detection and ranging], and thermal imaging, as well as cameras that capture high-resolution imagery. By incorporating these tools and the accurate data they produce in our transportation and infrastructure projects, we can analyze data to assist in making informed decisions regarding any infrastructure project throughout its lifecycle.

Specific use cases might be creating a digital base map for selection of an optimal preliminary alignment on a bus-rapid-transit project or light-rail project, or developing as-built site conditions for designing a major highway; performing 3D laser scanning of the interior of a building to perform as-built modelling of the mechanical, electric and plumbing infrastructure for BIM [building information modelling] efforts; supporting asset management efforts in developing a database of a particular municipality's sewer and water infrastructure, as well as updating, maintaining and managing the associated GIS [geographic information system] databases; or performing 3D laser scanning of a vertical wind turbine to create a digital twin of the structure.

Geospatial technology is essential to the creation and maintenance of digital twins, which replicate any structure or geographic environment and integrate associated real-time data. We utilize a combination of tools to develop the digital twin, considering the project needs and the design accuracy requirements. The project team and client must agree upon which methods to use based upon the accuracy

standards required for the project. It is important to know that each tool and method produce different accuracies; a geospatial professional can assist in making those decisions.

Has the COVID-19 pandemic brought a shift in the technologies used and the way geospatial work is carried out?

Barry Creed: While the COVID-19 pandemic continues to impact business functions, it has not drastically changed the way that data collection and data management is performed; however, the value of geospatial technologies shines in a world in which person-to-person contact is limited.

Remote sensing technology allows us to perform data collection and inspection without physically touching an object or being in proximity to another person. A lot of the tools we use require a single operator or pilot to oversee data collection and data management. In the pandemic, this practice has worked well; and the WSP geospatial team has also adapted by utilizing technologies to create virtual-reality meeting spaces, making it possible for project teams and clients to view projects remotely rather than through visitation to project sites.

How does human geospatial expertise bring value to increasingly digitized and automated processes?

Barry Creed: Human expertise will always have a place in data quality control and detecting model error. The model is only going to be as accurate as the quality assurance and quality control processes carried out by the person overseeing the automated process. While the use of artificial intelligence in automation and data analysis processes has improved efficiencies and speed, it is the professional who understands how to use this data and apply it to solve a problem. Often, the data analysis produces an accuracy statement that a seasoned geospatial expert knows is not possible due to environmental or technical issues in the data collection and management efforts. Having a geospatial professional review all the data in conjunction with detailed quality assurance and quality control will verify that a digital twin model is accurate.

In a broader context, what opportunity exists to help countries advance their efforts to meet sustainable development goals?

Barry Creed: Geospatial technologies continue to be an important tool in sustainability efforts across the globe. There are diverse scenarios of application where geospatial technologies are essential to human, social, economic and environmental preservation and advancement.

For example, drones and the imagery and videos collected from them are being used to perform major traffic studies. Such studies are used to design optimal traffic flows and identify hazard areas and potential crash areas in a real-time environment. In this way, the data contributes to improving road safety toward developing a sustainable transport system.

The agricultural industry has incorporated the use of unmanned aerial systems to perform real-time monitoring of crops. This data is incorporated into a digital dataset to help determine optimal crop yield, while prudently using resources.

Geospatial technicians utilize satellite imagery to provide real-time data on climate change. This data assists in documentation and modelling climate-change impact areas. These models are uploaded into a GIS database for forecasting

and data analysis of a variety of environmental factors that affect climate change.

LiDAR technology is changing the way WSP looks at sustainable forest management. This technology allows geospatial teams to monitor deforestation for the identification of invasive plants or insects, and identify any natural hazards that may harm the health of the forest. Subsequent improvement enhances the long-term health of the forest ecosystem, which results in additional economic, social and cultural opportunities for future generations.

Recent 3D laser scans have been used to create a digital twin of the Notre-Dame Cathedral in Paris for use in the rehabilitation of this famous site from the fire damage it sustained in 2019.

Remote areas in Cambodia, where archaeological teams had limited access, are now being mapped with low-level LiDAR. This mapping is leading to discoveries of the remains of ancient cities that were thought lost. Similar efforts are occurring across the globe. Such discoveries can broaden perspectives when developing today's infrastructure.

These are exciting times to be a geospatial professional; the industry's technologies are attracting a new generation of professionals who are pushing the envelope and bringing innovative ideas to the discipline. I look forward to the future and what we will accomplish.

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