Digital Cities

 Reality Modeling for Going Digital Strategy

IMAGE COURTESY OF CITY OF HELSINKI

Bentley
Advancing Infrastructure
Digital Cities connect and converge people, processes, data, and technology

As urban populations continue to grow, and governments struggle to deal with aging infrastructure, digital cities are emerging as the solution to manage and mitigate risks associated with changing environments. By connecting and converging technology, data, people, and processes, city planners are adopting a going digital strategy, which is quickly becoming part of the infrastructure lexicon.

Digital cities are taking advantage of new and exciting technology and leveraging the proliferation of reality modeling – the process of capturing existing site conditions with the use of digital photographs or point-cloud data. These 3D reality models can be easily shared and streamed, accelerating the decision-making process by improving collaboration with outside agencies and services.

Bentley’s ContextCapture application can generate 3D reality meshes that meet numerous needs, ranging from engineering-ready detailed information to city-wide contextual models to provide up-to-date information to support asset design, construction, and operations.

The 3D reality models can be used for a variety of purposes, including urban planning, as illustrated by Helsinki 3D+ for the City of Helsinki, to detailed engineering design and construction workflows, as done by Huadong Engineering Corporation Limited for the City of Shenzhen. As demonstrated by these six finalists in the 2017 Be Inspired Awards’ BIM Advancements in Reality Modeling category, going digital leveraging reality modeling allows for the realization of digital city goals.
The capital city of Amaravati is planning to build a world-class river walk community along the banks of the Krishna River in Andhra Pradesh, India. Clove Technologies was tasked with providing a virtual 3D model that combines existing data with planned environmental development and facility designs, as well as highly precise models for engineers, architects, designers, and city officials to use for conceptual planning and cost analysis. The proposed 14-kilometer project site across the river presented terrain challenges capturing the area amid islands and hills.

Using ContextCapture, the project team created a 3D reality mesh from UAV images and DGPS data with 3.2-centimeter accuracy. It used LumenRT to animate the proposed solution for beautifying the shores, as well as creating flood simulations for flood management planning. Bentley’s integrated and automated technology saved significant time generating the reality mesh compared to traditional survey and modeling methods and improved collaboration among stakeholders. The model facilitated detailed planning and analysis for this INR 1.5 million project.

**Project Playbook:** ContextCapture, LumenRT, MicroStation

ContextCapture and LumenRT have fulfilled the dream of a landscape designer in planning a riverbed of Amaravati. The creativity in a virtual world was presentable to government officials, ministers, and so on. The government was able to [receive] pre-estimates of the budgets required, the impact of floods on landscape, and settlements, among other things.

— KKVNRaju, Managing Director, Clove Technologies Pvt. Ltd.
Huadong Engineering Corporation Limited, PowerChina
Shenzhen City, Guangdong, China

Application of BIM Strategy for Shenzhen Qianhai Municipal Infrastructure

In Shenzhen, Guangdong, China, the Qianhai Cooperation Zone is undergoing intense development, with nearly CNY 390 billion of dense construction covering an area of 14.92 square kilometers. The planned activity includes more than 180 kilometers of roads and 32 kilometers of rail lines aboveground and belowground, and CNY 68.2 billion in infrastructure. Huadong Engineering Corporation (PowerChina) is responsible for the infrastructure and other major projects.

Huadong Engineering’s daily management and coordination of BIM implementation ensured that the team leveraged the technology to solve the numerous challenges. A 3D reality model of the zone, used with the project’s multi-discipline 3D design models, created a GIS-based view for resolving errors, omissions, collisions, and deficiencies. Using the 3D collaborative design helped save more than CNY 21 million in averted rework alone.

Project Playbook: AECOsim Building Designer, Bentley Raceway and Cable Management, ContextCapture, Descartes, LumenRT, MicroStation, Navigator, OpenRoads Designer, OpenRoads Navigator
The Yangzhou Municipal Planning Bureau retained Haiwei Spatial Information Technology to perform data acquisition and reality modeling services to establish an accurate 3D city model for decision making, planning, and development of Yangzhou, China. The resulting model gave government officials and planning designers the ability to visualize potential development initiatives and served as a basis for using reality modeling for urban development in other Chinese cities.

Using ContextCapture, the project team processed 800,000 photos captured with UAVs and generated a 3D reality mesh in 20 days, compared to 10 months using manual processes. Descartes enabled the team to edit 400 surface models in three days. MicroStation provided the interoperability to integrate multi-sourced data and produce a digital, urban 3D GIS platform. Bentley’s integrated applications allowed the team to deliver the project 10 days ahead of schedule and save an estimated CNY 1.2 million on this CNY 4.5 million project.

**Project Playbook:** ContextCapture, Descartes, MicroStation
Bentley’s ContextCapture enhances efficiency by several times. The computing capacity for the modeling in an individual machine can reach 30 gigapixels per day. It reaches 120 gigapixels per day if we use four machines to process data interactively. The traditional methods cannot keep up.

– Dan Guo, 3D Modeling Technology Processor, Shanghai Hangyao

Shanghai Hangyao
Qinghai, China

Xining Smart City Initiative

In 2014, Xining began its smart city initiative by capturing 40,000 images of 7,600 square kilometers of its city. Shanghai Hangyao, experienced with digital city projects, was tasked with completing this reality modeling initiative. Using ContextCapture, the project team generated the city’s first intuitive and informative 3D reality mesh, a true 3D digital asset. The land authority and police agencies used the 3D reality mesh to detect unauthorized construction, perform real estate registration, and confirm land ownership. Other agencies across the government can stream the data over an internal network, overlaying it with their theme layers to conduct professional analysis locally.

The parallel computation architecture and the automatic reality modeling capability of ContextCapture empower the ambition of the large city mapping project. Compared with the traditional modeling workflow, ContextCapture efficiently accomplished the reality mesh production for large-scale mapping, as well as saved CNY 10 million in project costs.

Project Playbook: ContextCapture
The City of Helsinki, Finland has a long tradition of 3D city modeling dating back to the mid-1980s. As part of a three-year project to be completed in 2017, the City of Helsinki launched a EUR 1 million project to generate a 3D representation of the entire city. When completed, the model will be provided as open data to involve the public and to encourage commercial research and development.

The team used Bentley Map to create accurate base maps and geo-coordinate utility networks. ContextCapture was used to generate a 3D mesh representation of the city and Pointools to model the surface and terrain. LumenRT was used to enliven designs. Lastly, the team used ProjectWise for collaborating and managing all the data that would be uploaded to a web portal for distribution and general access. As part of its digital city initiative, the 3D model will improve Helsinki’s internal services and promote smart development. The project will also showcase the technology and promote its use in higher education.

**Project Playbook:** ContextCapture, Descartes, Pointools, LumenRT, Bentley Map

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*Future cities need advanced tools and innovative city models for creative design and well-grounded decisions.*

– Jarno Suomisto, Architect, Project Manager, Helsinki 3D+
For this INR 86.8 billion urban mass transit project in Nagpur, India, Maharashtra Metro Rail Corporation Limited (Maha-Metro) implemented a comprehensive BIM approach with a consortium of engineering consultants from conceptual design through construction, operation, and maintenance. The project team used ProjectWise and AssetWise to create a connected data environment and improve design integration and collaboration among the design teams.

Using Bentley’s integrated design applications to produce the entire infrastructure model enhanced collaboration, accelerated design time, and improved project reliability, which helped save 50 percent in engineering time and costs. Implementing a BIM methodology enabled real-time collaboration and simulation, which minimized changes and avoided rework. The intelligent BIM model allows for asset management throughout operations and maintenance for full lifecycle infrastructure management.

Project Playbook: AssetWise, MicroStation, Navigator, OpenRail, ProjectWise
AEROMetrex Pty., Ltd.
Philadelphia, Pennsylvania, United States

Reality Modeling for the Papal Visit to Philadelphia

The Pope’s visit to Philadelphia in September 2015 was the largest public event held in the United States that year. Attracting more than 1 million people, the Papal visit required extensive preparations. AEROMetrex developed a 3D reality model of the city to assist in planning. Accurate to within 5 centimeters, the photo-realistic 3D model included every stationary object including vegetation, sculptures, and buildings.

In a four-week period, the team obtained and processed more than 28,000 images using ContextCapture, saving an estimated 200 hours of survey time and AUD 24,000 in costs. By providing perspectives from any vantage point, the model’s utility extends beyond its original use for facility and security planning, and will be used in the future for urban planning, and disaster and transport management.

Project Playbook: ContextCapture

This project was not only a technical and financial success but was also a showcase of the capabilities of ContextCapture for realistic, comprehensive, 3D reality modeling. We believe this is the mapping system of the future.

— David Byrne, technical director, AEROMetrex
About Bentley Systems
Bentley Systems is a global leader in providing engineers, architects, geospatial professionals, constructors, and owner-operators with comprehensive software solutions for advancing the design, construction, and operations of infrastructure. Bentley users leverage information mobility across disciplines and throughout the infrastructure lifecycle to deliver better-performing projects and assets. Bentley solutions encompass MicroStation applications for information modeling, ProjectWise collaboration services to deliver integrated projects, and AssetWise operations services to achieve intelligent infrastructure—complemented by comprehensive managed services offered through customized Success Plans.

For additional information, visit www.bentley.com.

About ContextCapture
ContextCapture is Bentley’s reality modeling software that can quickly produce 3D models of existing conditions for infrastructure projects of all types, derived from simple photographs and/or point cloud. Without the need for expensive or specialized equipment, ContextCapture enables users to quickly create and use these highly detailed 3D engineering-ready reality meshes to provide precise real-world context for design, construction, and operations decisions throughout the lifecycle of projects. Project teams can easily and consistently share reality modeling information, consumable and accessible, on desktop and mobile devices, in many formats, including native use within MicroStation for any engineering, operations, maintenance, or GIS workflow.

For additional information, visit www.bentley.com/ContextCapture.