



**Bentley**<sup>®</sup>  
Sustaining Infrastructure

## 3D City GIS for intelligent cities

**Bentley defines a 3D City GIS as information technology that provides the functionality required to enable the management of data, user workflows and processes related to a city's infrastructure**

**B**entley is the global leader dedicated to providing architects, engineers, geospatial professionals, constructors and owner-operators with comprehensive software solutions for sustaining infrastructure. Bentley software empowers its users to leverage information modeling through integrated projects for high-performing intelligent infrastructure, including the intelligent cities of today and tomorrow.

Founded in 1984, Bentley has come a long way since its inception and now has nearly 3,000 colleagues in more than 45 countries around the

globe. The company has invested more than US\$1 billion in research, development and acquisitions during the past decade in its quest to deliver solutions to its clients, who in turn use these solutions to build smarter, sustainable infrastructure.

Bentley's comprehensive portfolio of offerings is designed to be used throughout the lifecycle of an infrastructure asset. The software is customized to the exact needs of various professionals who will use it for everything from infrastructure project planning to the operations and maintenance phase of these assets.

## BENTLEY'S 3D CITY GIS

Governments around the globe are taking steps to build sustainable cities in a bid to help their citizens achieve an improved quality of life. Sustainability includes everything from the layout of a city to enhanced reliability of the utility infrastructure. While the need for sustainable infrastructure led to 2D GIS initiatives at first, over the years they have evolved to become innovative 3D City GIS projects.

Bentley defines a 3D City GIS as information technology that provides the functionality required to enable the management of data, user workflows and processes related to a city's infrastructure. It includes a reference 3D city model suitable for the management and geocoordination of detailed infrastructure information. This model can provide information ranging from a geographic scale overview of the 3D urban assets to a detailed engineering view of specific infrastructure assets. It also provides a framework supporting the information lifecycle from its creation to its exploitation by different stakeholders.

The enormous power that a 3D City GIS bestows upon planners allows them to build infrastructure that is not only pretty but also

**"The future holds a smart 3D model that contains analytical information as well as geometries. MicroStation gives us extensive visualization tools, and we anticipate that we will continue to develop these and add new ones."**

**- Jarmo Suomisto**  
IT Manager  
City Planning Department  
City of Helsinki

intelligent. It provides a comprehensive model of the city that includes both above-ground and below-ground infrastructure information to help in the proper design and maintenance of the utility infrastructure. A 3D City GIS is about creating a semantically rich model providing engineering-level accuracy. This approach sets Bentley apart from traditional mapping strategies. With its wide range of offerings in this sphere, Bentley is at the center of making 3D City GIS initiatives a practical venture.

## Bentley Map

Bentley Map is a feature-rich GIS that is intrinsically 3D. It meets the requirements of organizations that map, plan, create and manage the world's infrastructure and facilitates the creation, maintenance, sharing and analysis of 2D/3D geospatial information. It also supports the development of custom GIS applications. Bentley Map gives users the ability to:

- Leverage native Oracle Spatial to store and edit all types of spatial data
- Utilize smart 3D object editing tools
- Analyze 2D and 3D spatial data
- Access and manage heterogeneous data
- Produce high-quality 3D scenes and animations
- Publish superior quality maps
- Get started quickly on 3D City GIS projects using Bentley Map's CityGML-based data model

Bentley Map is offered in three editions aligned with different user requirements:

- **Bentley Map PowerView:** Visualization and editing of 2D/3D geospatial information (stand-alone);

**"Bentley is a strong supporter of open standards in geospatial workflows. With this rich support for the CityGML OGC standard, Bentley enables its users to meet the increasingly demanding requirements for planning and managing the world around us. Intelligent 3D City models based on CityGML are the future for cities, and every city needs to have a strategy for beginning the migration from 2D GIS to 3D City models."**

**- Jantien Stoter**

Consultant - Product and Process  
Innovation, Dutch Cadastre,  
and Associate Professor, TU Delft

→ **Bentley Map:** Editing, analysis and management of 2D/3D geospatial info including map finishing and advanced parcel management tools (runs stand-alone or on MicroStation);

→ **Bentley Map Enterprise:** Enterprise editing, analysis and management of 2D/3D geospatial information, together with advanced raster image management and solids texturing for 3D city workflows (stand-alone).

## Bentley Geospatial Server

Bentley Geospatial Server brings together information in spatial databases, drawings, business documents and other forms through a unique federated information management approach. Information in enterprise databases, legacy and departmental systems and project-based data stored in virtually any format is accessible to users through a spatial interface. One of the most advantageous features of Bentley Geospatial Server is that it manages information through a distinct approach that depends on the indexing of information instead of converting it into a common format, which allows information to be easily accessible, viewed and edited with the help of users'

**"Bentley is clearly in the lead with its approach to 3D GIS."**

**- Sisi Zlatanova Dr. Eng.**  
Associate Professor  
Department of Geodesy  
Delft University of Technology

preferred tools directly from the Bentley Geospatial Server interface. It is possible to use spatial and non-spatial criteria to locate the information users want and to employ spatial referencing to make sure the user never overlooks any information. Bentley Geospatial Server offers enterprise access to the spatial data repository for 3D City GIS projects.

## Bentley Descartes

Fully integrated with MicroStation, the Bentley Descartes imaging software offers users the ability to attach/view, edit, transform/geo-reference and process all raster data in a single application. It can display nearly all of the common industry raster file formats as well as data through Web Map Service (WMS). Apart from displaying raster digital elevation model, Bentley Descartes' thematic display tools can show slope, elevation and aspect using custom color displays. The software can also be used to browse, query, attach and display rasters saved in Oracle Spatial.

Bentley Descartes contains

tools such as paint, erase, remove, speckle and flood to complete engineering or mapping workflows on raster data. Other specialized tools, including local transform, move, scale, rotate, mirror and warp, are also available. All of these operations can be done on 2D and 3D-oriented rasters. Specifically, Bentley Descartes is used to apply textures to solids to support 3D city workflows.

## Bentley Geo Web Publisher

Bentley Geo Web Publisher offers the advantage of high-performance publishing to combine various data sources, author and administer web GIS applications and get the most out of users' geospatial information. It enables a wide range of applications, such as municipal information systems, image or drawing archives, map-based navigational sites, project sites and public information portals.

Integrated vector and image server engines publish hybrid vector/ raster datasets and other formats, making it easy to incorporate drawings, maps, models, aerial photography and images within custom browser presentations.

Bentley Geo Web Publisher is built on a publishing workflow optimized for publishing geospatial data, which allows it to publish

from a broad choice of data sources spanning DGN, SHP, TAB, DWG, raster images and information created by Bentley GIS products as well as information in relational databases, including Oracle Spatial.

Bentley Geo Web Publisher is compliant with Open Geospatial Consortium (OGC) Standards such as WMS and can act either as a

**"Bentley products and Oracle Spatial have been used for many years at the City of Montreal. Integrating Bentley Geospatial Server and Oracle Spatial 10G is effortless and efficient. Moreover, using Bentley Geospatial Server we were able to inventory and centralize the existing information regarding municipal infrastructure in order to provide a valuable tool for city planners at all levels."**

**- Gaéтан Guibord**  
Team Lead - Planning and Operations  
Geomatics Department  
City of Montreal

WMS server or a client as well as a WFS server. This allows information to be published to users who need to incorporate it into another WMS application, or to incorporate information into their own presentation from any available WMS server. Bentley Geo Web Publisher is used to publish and query 3D city models.

## USING CITY INFORMATION MODELING FOR SUSTAINING CITIES

Information modeling is a major trend in the infrastructure sector that can range in scale from a building to an entire city. Bentley, with the goal of powering sustainable infrastructure, has been developing software for this purpose for more than 27 years. Presented on the next page are a few case studies in which information modeling has been used extensively to support 3D city models.

## >> The City of Helsinki

### HELSINKI, FINLAND

#### ► Project Objectives

Ensure an integrated approach to city-wide planning that delivers an intelligently planned and aesthetically pleasing city;

Improve communication and discussion with residents;

Accelerate the design and approval of city planning proposals.

#### ► Products Used

Bentley Descartes, MicroStation, ProjectWise



City of Helsinki 3D model

The City of Helsinki is in the process of developing a 3D digital model of the entire city that forms the basis of all design and building permit workflows. The use of the 3D model extends across numerous functional city departments such as urban planning, building permit management, mapping, civil defense planning, civil engineering, noise simulation and traffic simulation. With over 500 users, the city is an enterprise-level user of MicroStation.

## >> The City of Montreal

### MONTREAL, QUEBEC, CANADA

#### ► Project Objectives

Encourage the use of 3D geospatial data among all constituents;

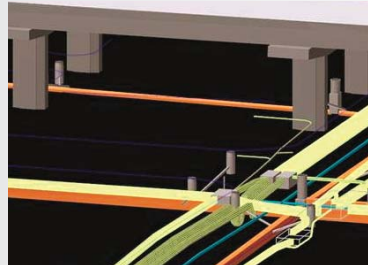
Generate precise representations of city's infrastructure with the help of open and interoperable tools;

Leverage commercial off-the shelf software for 3D city model maintenance;

Improve workflows associated with applying textures to 3D buildings.

#### ► Products Used

Bentley Descartes, Geo Web Publisher, Bentley Geospatial Server, Bentley Map, MicroStation



The City of Montreal is expanding the 3D model to include its underground assets

The City of Montreal has been using Bentley technology for several years and has taken a leadership role in developing processes and using software to create an intelligent 3D city model. The geomatic engineering department in the city, which is responsible for providing geospatial data to various stakeholders for infrastructure projects, stores 3D object-oriented

data in Oracle Spatial 11g. A centralized database provides fast and secure access to the intelligent 3D city model.

## >> Crossrail

### LONDON, ENGLAND

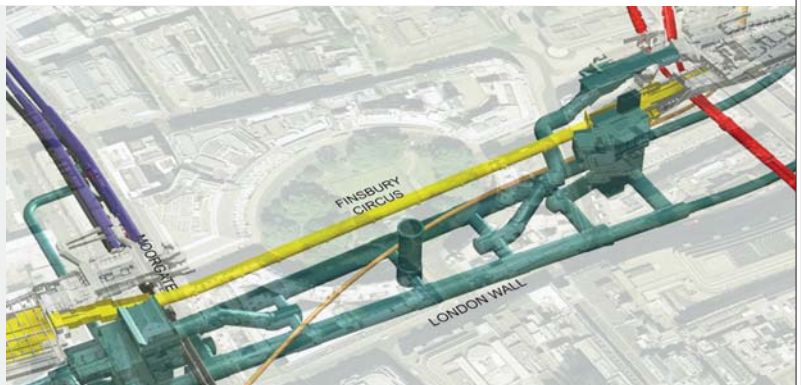
#### ► Project Objectives

Connect the east and the west of London with new rail infrastructure;

Establish effective coordination between the various agencies involved in the project.

#### ► Products Used

Bentley Geo Web Publisher, Bentley Map, MicroStation, ProjectWise,



Existing rail tunnels and planned Crossrail infrastructure in 3D

The ambitious Crossrail network will substantially reduce travel time between London's major business districts and benefit more than 1.5 million people. Crossrail's project documentation as well as its designs were 3D from the outset. The project planners started with a complete survey of above and below-ground infrastructure using several techniques such as aerial images, laser scanning and ground radar. The designs are based on a 3D model of the existing infrastructure, which is the best way to deal with a project of such complexity.

For additional information, please visit [www.bentley.com/3DCityGIS](http://www.bentley.com/3DCityGIS)