



CityGML based 3D modeling with Bentley MicroStation V8i & Bentley Map V8i

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Transport & Local Infrastructure

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Agenda

- About Bentley Systems
- Benefits of a XML-based data scheme with 3D modeling workflows based on **MicroStation V8i** and **Bentley Map V8i**
 - The **Geospatial Administrator** as XFM Engine for the CityGML catalogue
- **A typical workflow for 3D City modeling in Bentley Map V8i**
 - Using FME as Data Exchange (Import and Export)
 - Modeling and promotion of 3D Objects to CityGML
- Opt.: 3D City Management with Bentley Geospatial Server and Oracle Spatial
- Summary & Discussion

About Bentley Systems

MINING

- STAAD
- OpenPlant
- Recovery and Cable Management
- InRoads
- Bentley Map
- Decurates
- GEOPAK
- gINT
- RAM

WATER & WASTEWATER

- WaterGEMS
- SewerGEMS
- AutoPIPE
- OpenPlant

BUILDINGS

- AECOsim
- Generative Components
- RAM
- ProStructures
- MicroStation
- gINT

CONSTRUCTION

- Construction
- ProjectWise
- Navigator
- ProStructures
- MicroStation

3D CITIES

- Bentley Map
- Geo Web Publisher
- Decurates
- InRoads
- AECOsim
- Geospatial Server

NUCLEAR

- AutoPIPE
- OpenPlant
- Recovery and Cable Management

ROADS

- InRoads
- GEOPAK
- MX
- SUPERLOAD
- LEAP
- RAM
- gINT

RAIL & TRANSIT NETWORKS

- Bentley Rail
- Optima
- InRoads
- MX
- RAM
- GEOPAK
- LEAP
- gINT

SUBSURFACE UTILITIES

- WaterGEMS
- SewerGEMS
- MicroStation
- RAM
- GEOPAK
- gINT
- InRoads
- MX

POWER PLANTS

- AutoPIPE
- OpenPlant
- AutoPIPE
- AutoPIPE
- STAAD
- ProStructures
- Recovery and Cable Management
- AECOsim
- RAM
- gINT
- Decurates
- GEOPAK
- InRoads
- Bentley Map

BRIDGES

- RAM
- LEAP
- SUPERLOAD
- GEOPAK
- InRoads
- gINT
- MX
- ProStructures

CAMPUSES

- Bentley Map
- Decurates
- Geospatial Server
- AECOsim
- RAM
- STAAD
- Recovery and Cable Management
- GEOPAK
- InRoads
- gINT
- MX
- OpenPlant

UTILITY NETWORKS

- Substation
- MicroStation
- Decurates
- GEOPAK
- gINT
- InRoads
- MX
- OpenPlant
- STAAD

COMMUNICATIONS NETWORKS

- Bentley Fiber
- Bentley Core
- Inside Plant

PROCESS PLANTS

- OpenPlant
- AutoPIPE
- Recovery and Cable Management
- AutoPIPE
- AutoPIPE
- ProStructures
- STAAD

WIND FARMS

- SACS
- STAAD
- ProStructures
- Rebarlink

OFFSHORE

- SACS
- FormSys
- AutoPIPE
- STAAD
- ProStructures
- Construction

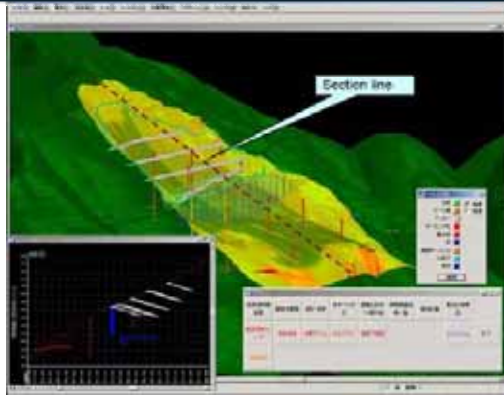
Sustaining Infrastructure
Bentley's Solutions

• MicroStation • ProjectWise • AssetWise • Navigator

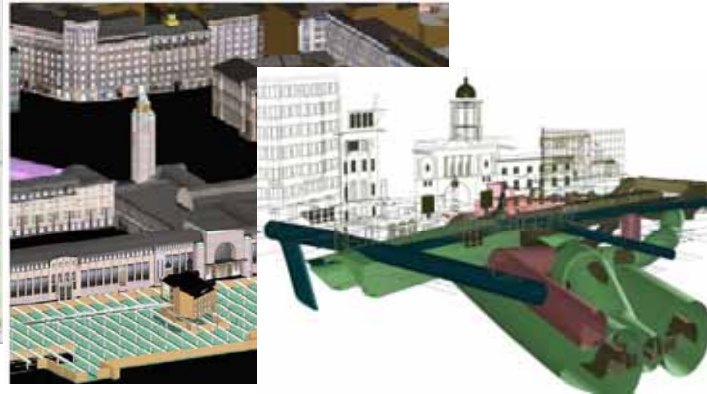
Bentley
Sustaining Infrastructure

Bentley's Strategy in 3D City Management

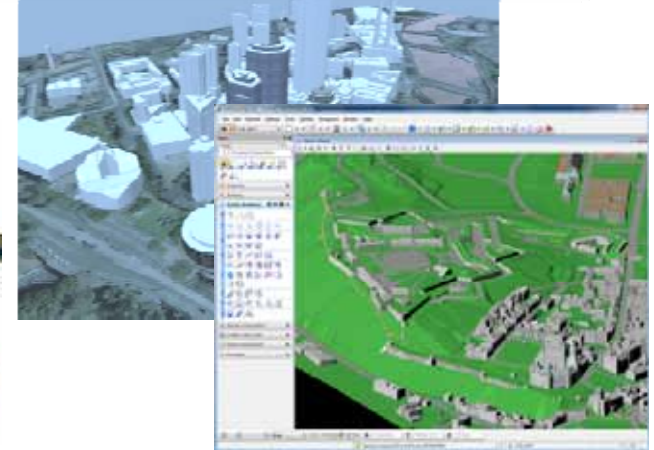
Terrain modeling &
Point cloud 3D modeling



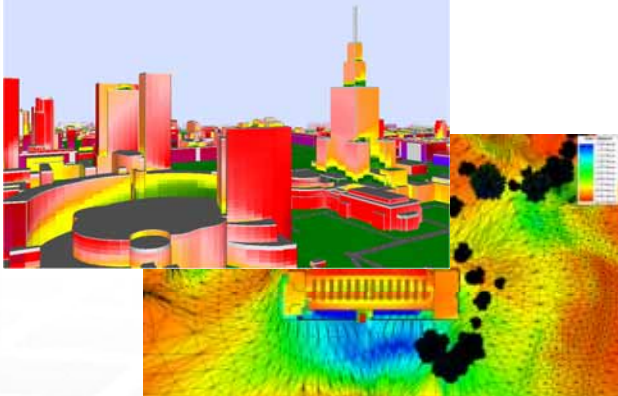
CAD Engine
Bentley MicroStation V8i



CityGML based modeling
FME Engine integrated



Noise simulation,
Solar Analysis



3D Shadow analysis

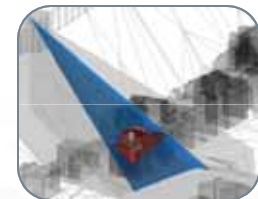
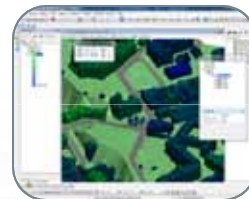
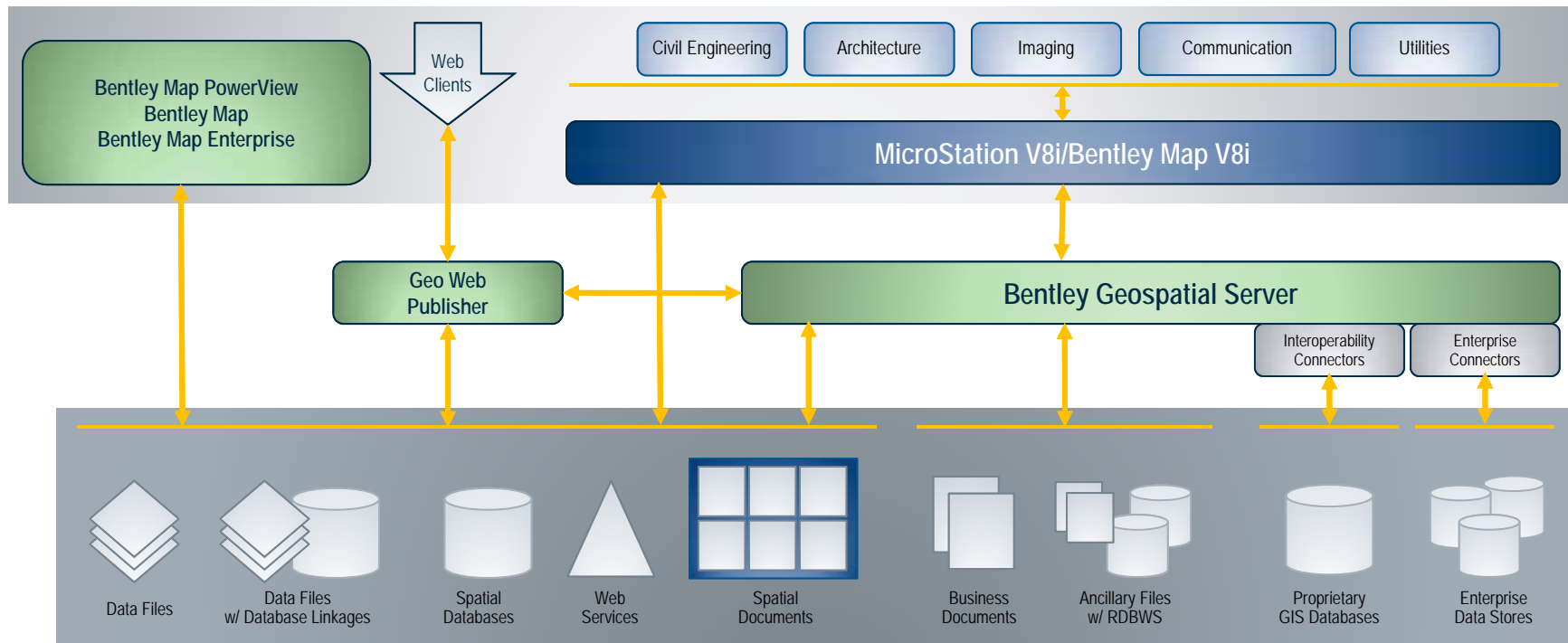


Visualization



Bentley 3D City Management Architecture

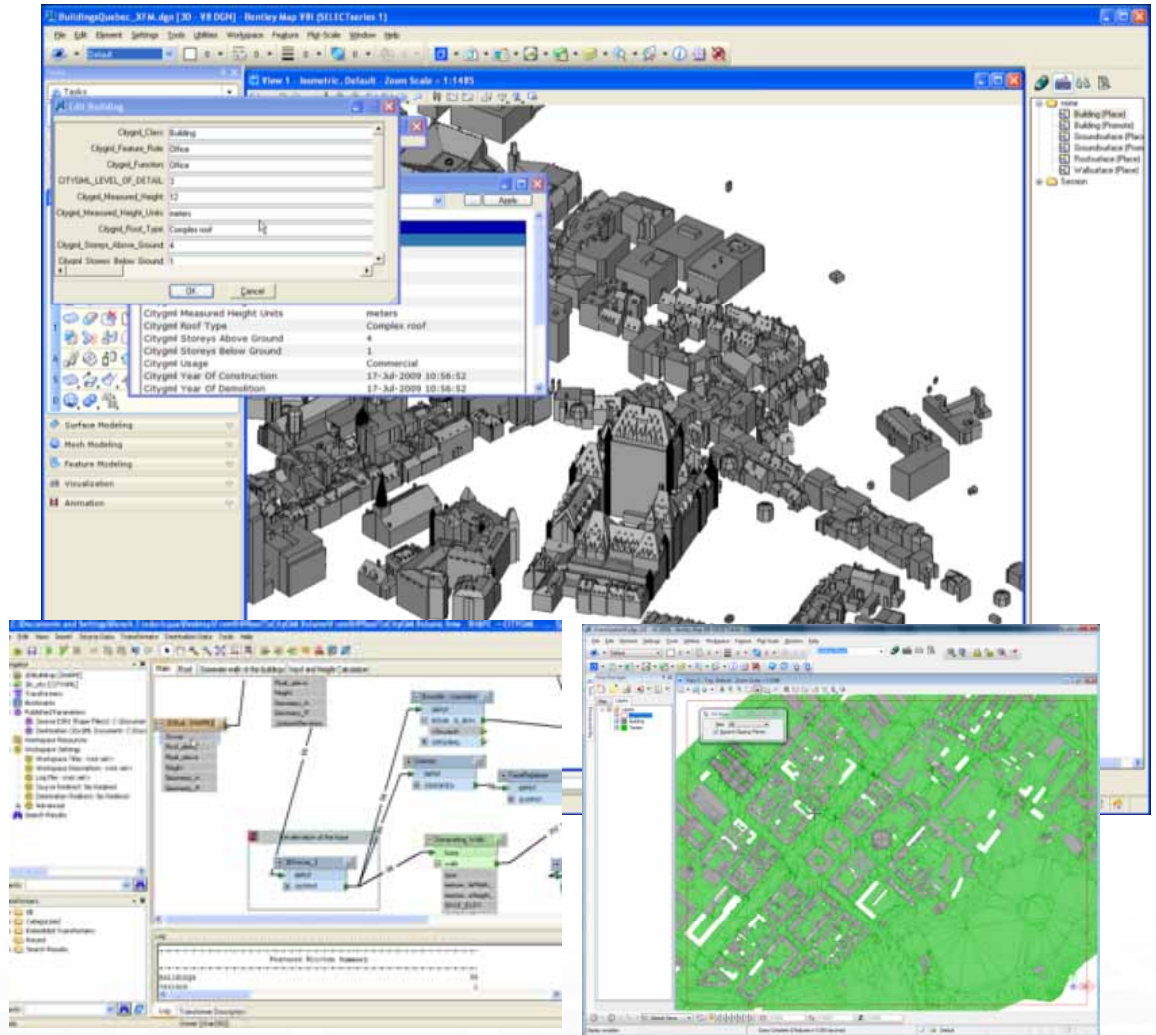
CIM = City Information Management



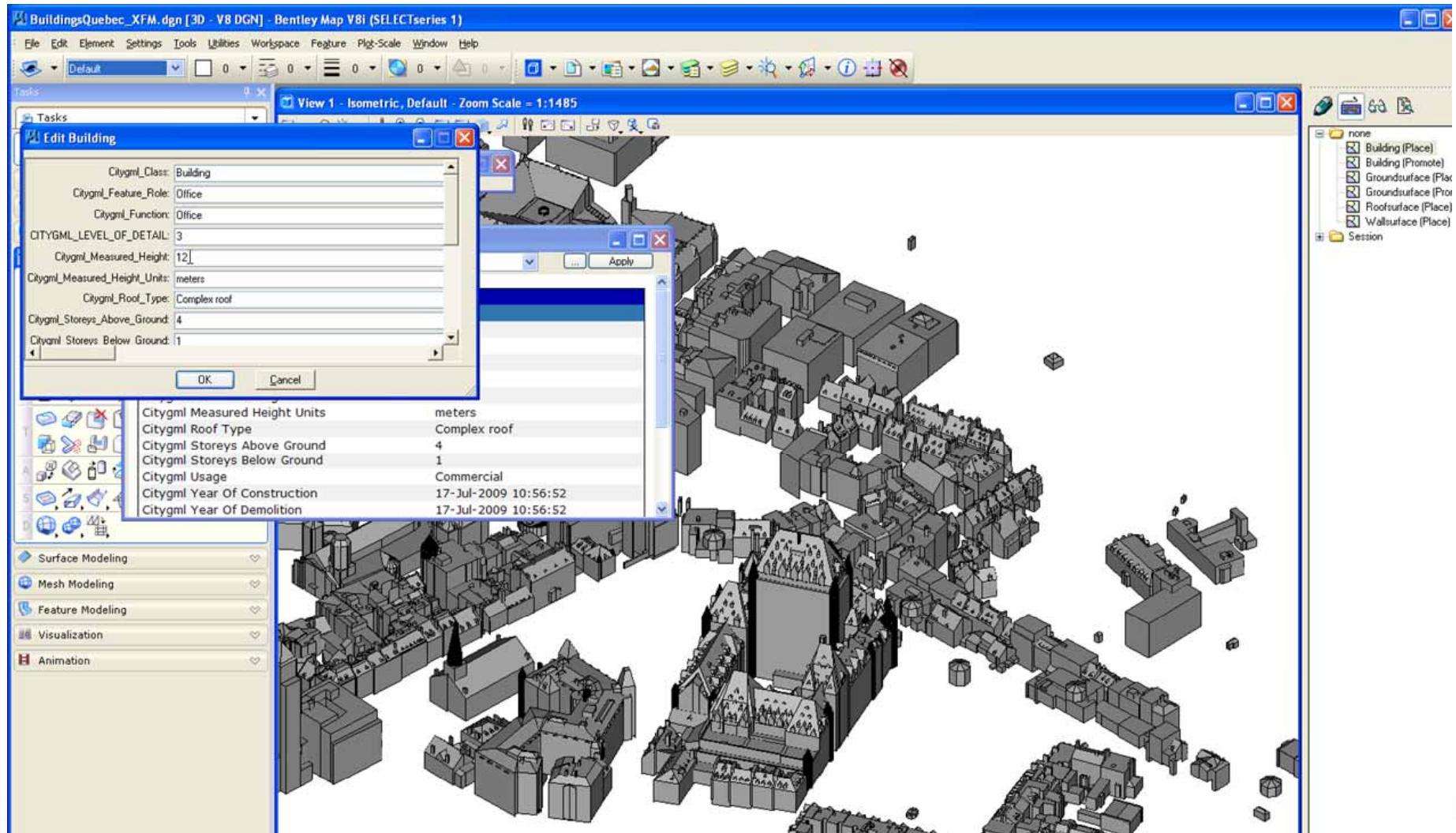
Bentley Map V8i Enterprise

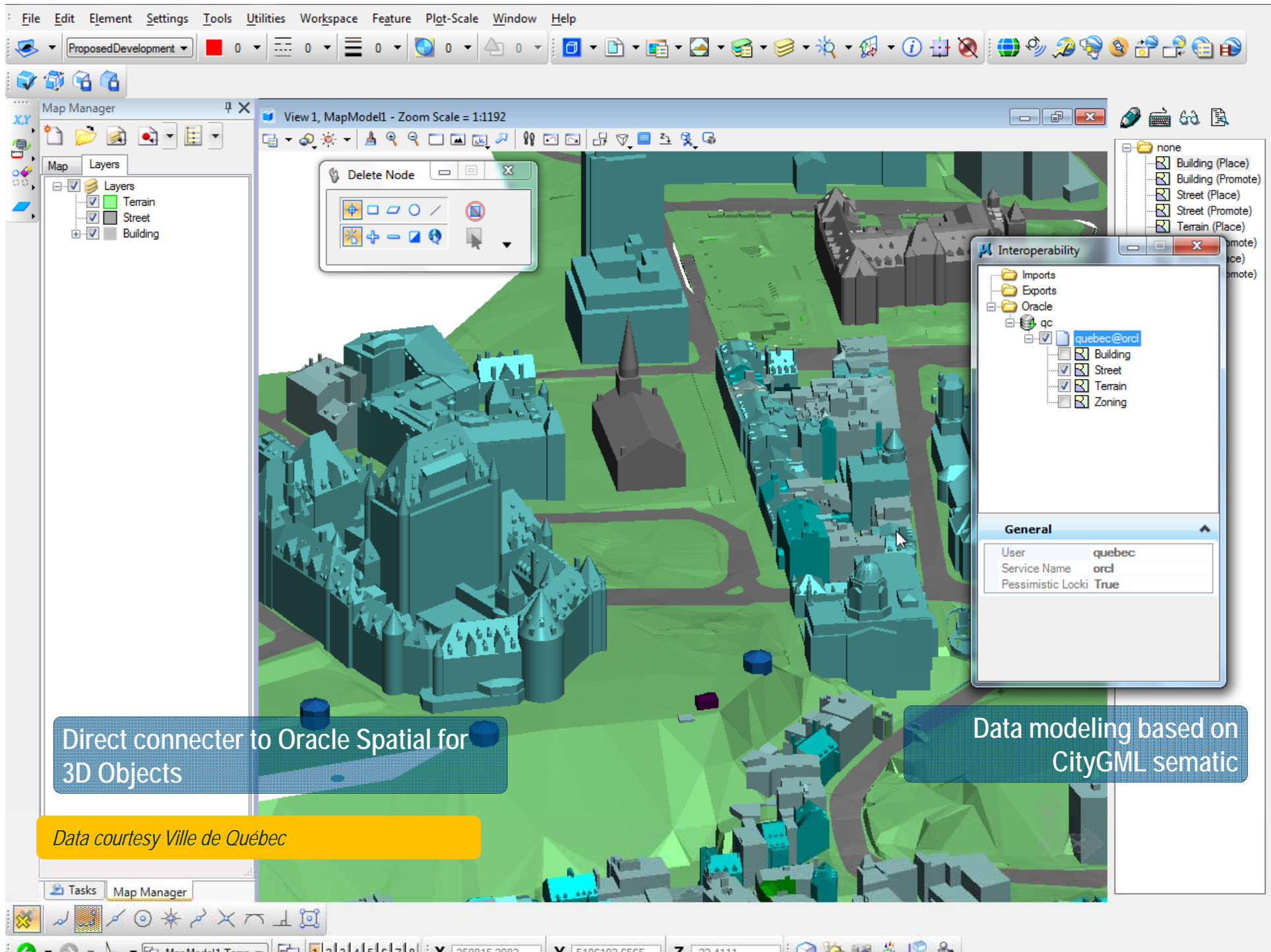
The 3D City Management Desktop Applikation

- Export & Import CityGML
- Editing and Analysis of attributes
- Use of native SHP Files
 - 2D SHP to 3D LoD1
- Integration of additional GEO-Standards (FME)
 - NAS (EDBS)



Bentley Map V8i - 3D FME Integration





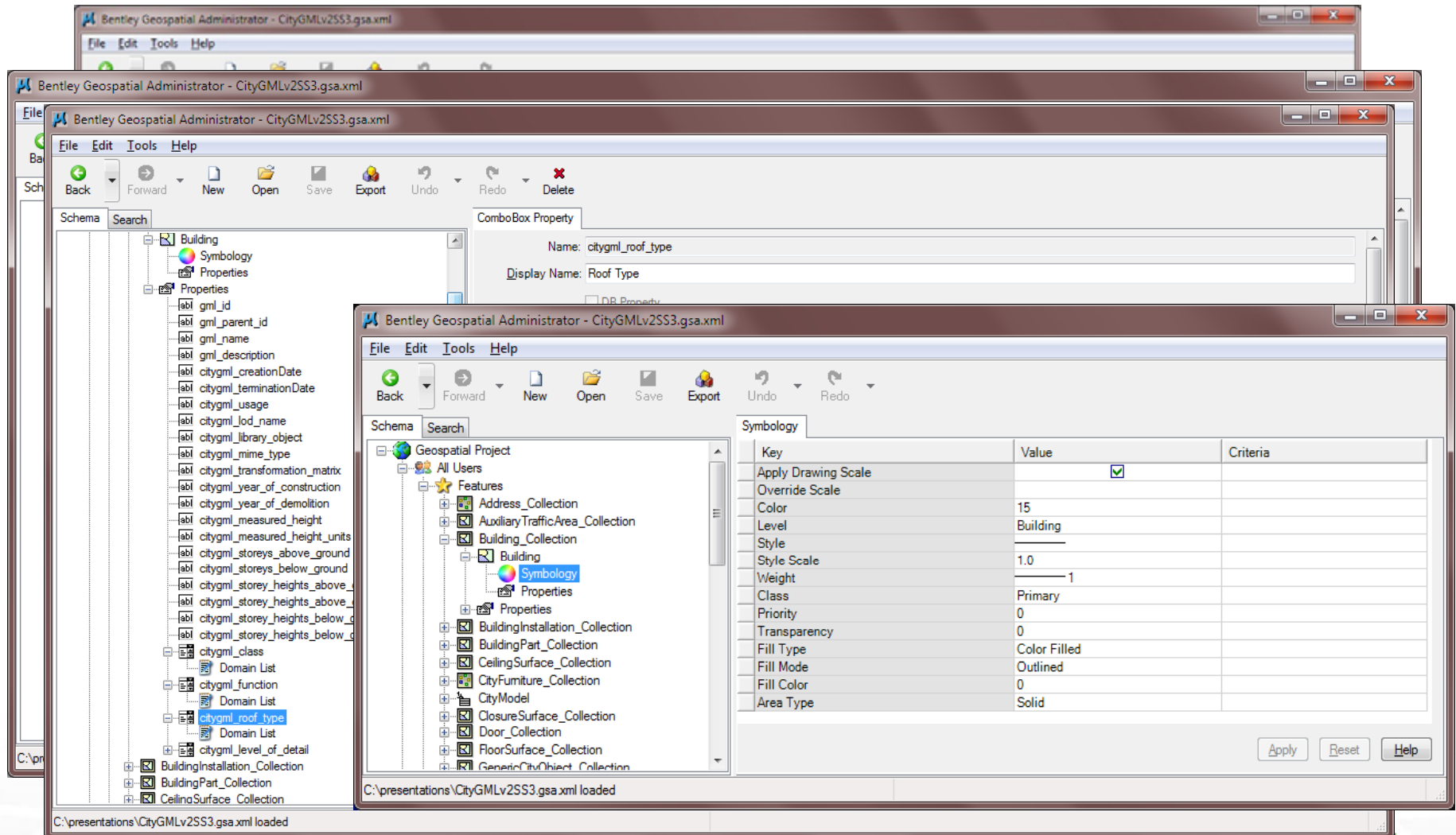
Direct connector to Oracle Spatial for 3D Objects

Data modeling based on CityGML semantic

Data courtesy Ville de Québec

Bentley GeoSpatial Administrator V8i

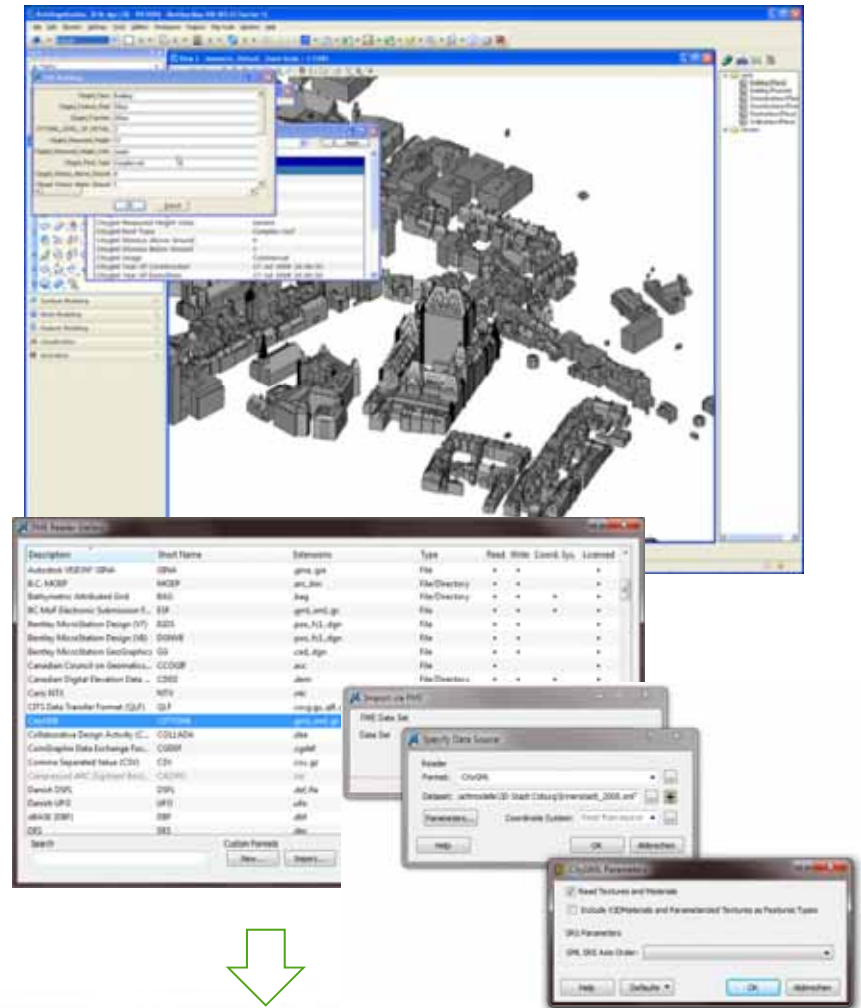
Support of CityGML catalogue



Bentley Map V8i - 3D Modeling Workflow (CityGML)

Typical Workflow Scenario:

- ↓ - Import of CityGML: 3D Citymodel according specification
- ↓ - Viewing and editing of attributes
- ↓ - 3D modeling and editing of an existing citymodel according the requirements of CityGML
- ↓ - Amendment with new buildings and objects based on CAD and BIM
 - 3D Solids, 3D surfaces, meshes, 3D Polylines etc.
- ↓ - Promotion of new objects to CityGML 1.0 – 2.0 specification
- ↓ - Export of the expanded model according CityGML specification

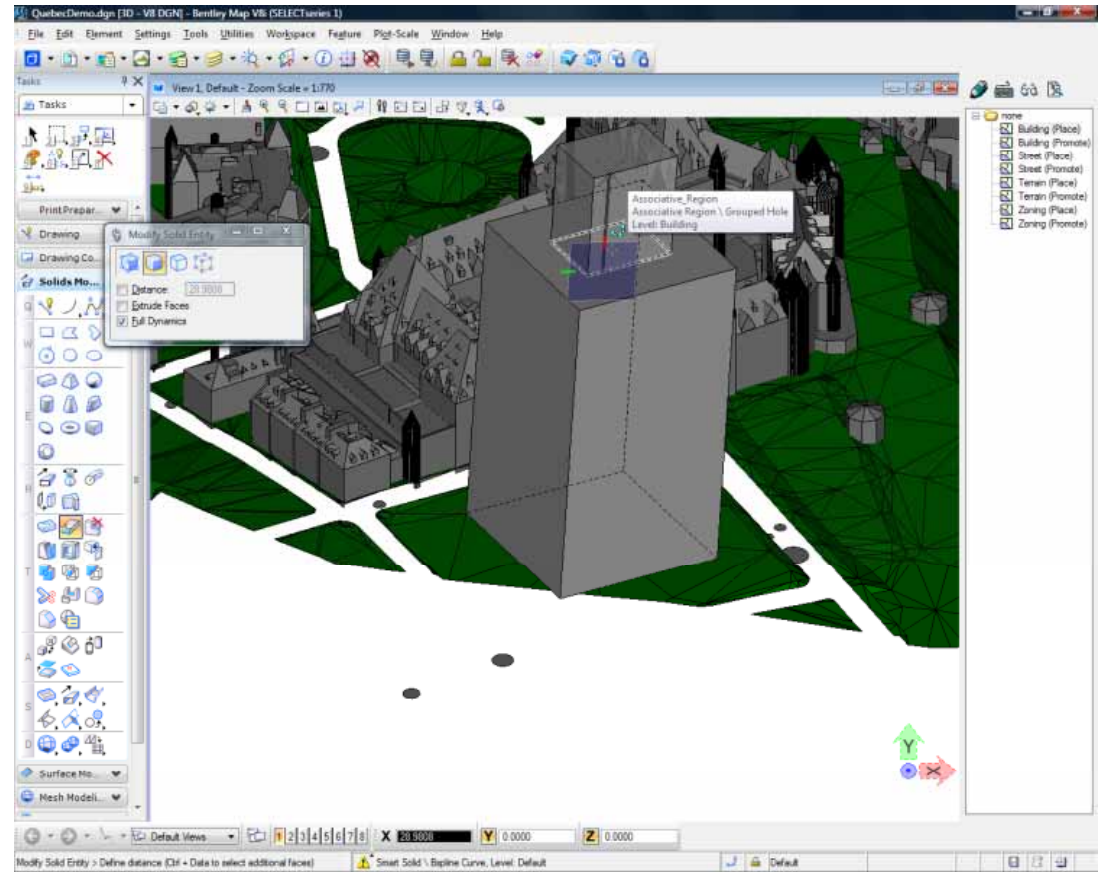


Data provided by Quebec City, Canada

Bentley Map V8i - 3D Oracle Spatial

Workflow:

- Sketch a new building in an existing urban environment
 - Using of 3D Solids
- Promote to CityGML scheme
 - According semantic definition with Bentley Geospatial Administrator
- Post to Oracle
- Optional:
Modify the building
 - Post to Oracle



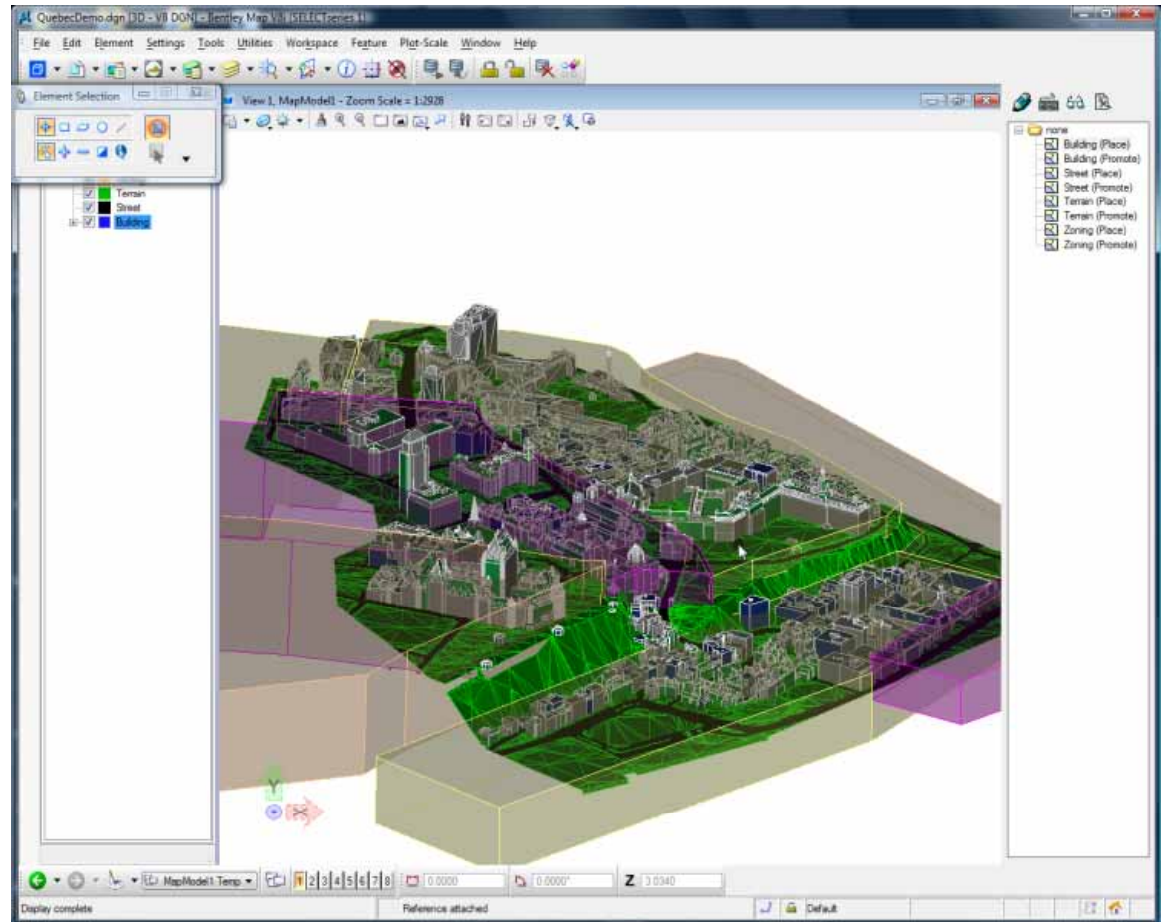
Data provided by Quebec City

Demonstration

Bentley Map 3D - CityGML Support with Oracle

Workflow:

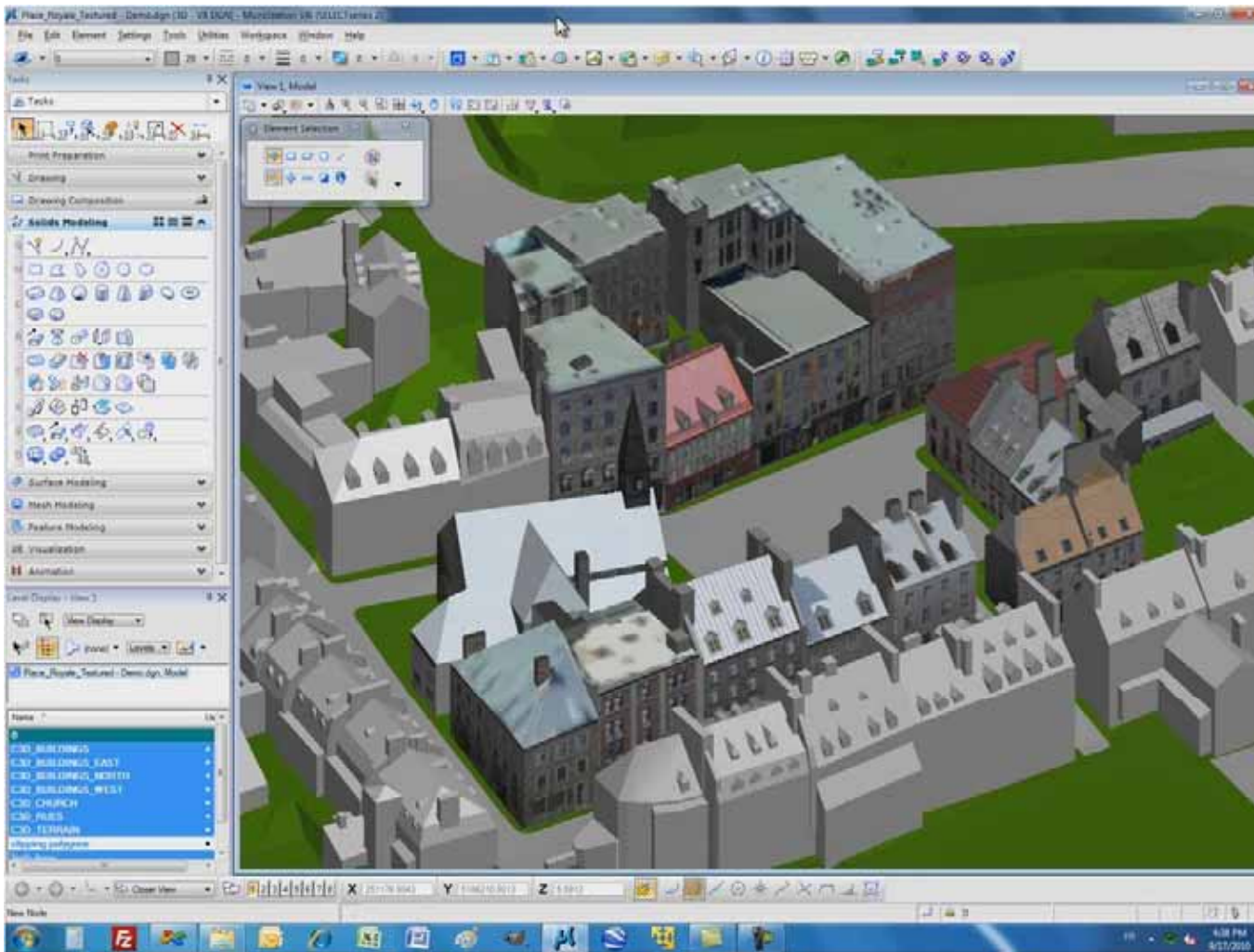
- Query Oracle Spatial 3D data according CityGML scheme
 - Query Buildings
 - Query streets and terrain
- Thematic mapping based on CityGML classification
 - Overlay with zoning areas and defined height limits



Data provided by Quebec City

Demonstration

3D Texturing with Bentley Map Enterprise V8i



Demonstration

Result of 3D City Model Animation with BIM Objects

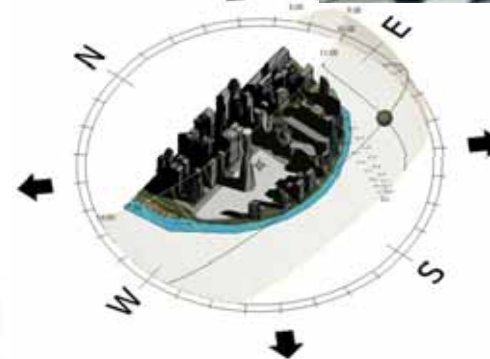
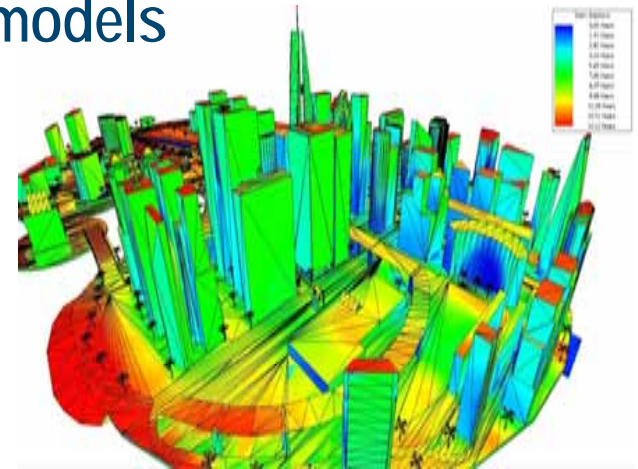


Animation

The application: Bentley Map Enterprise V8i

Capturing, Modeling and Analysis of 3D Citymodels based on Bentley MicroStation V8i

- **3D Modeling** with Solids, 3D surfaces, point clouds, textures etc.
- Interoperable through FME Engine
- Optional 2 tier & 3 tier connection to **Oracle Spatial & Microsoft SQL Server**
- Excellent **plot tools** with direct STL Support for **3D printing**
- Monitoring and 3D Analysis of 3D citymodels
 - Production of **thematic maps in 3D**
 - Reports and queries based on attributes and semantic
 - Report generation
- **3D developer platform with API**
 - 3rd party applications, made for Government



Bentley White Paper – 3D City GIS Commitment

The Benefits of a 3D City GIS for Sustaining City Infrastructure

A Bentley White Paper
Benoit Frederique, Product Manager 3D City GIS Products
Alain Lapierre, Senior Director, Civil and Geospatial Frameworks



Introduction

Infrastructure serves as the interface between people and the planet. It is used on a daily basis and can have a major impact on the lives of the global population. A case in point is the recent cholera epidemic in Haiti, which claimed more than 4,000 lives and was, in part, caused by contaminated water and sanitation systems. Other issues in which it has an important role to play include CO2 emissions, climate change, severe weather, terrorist attacks, coastal flooding, hazardous waste, and non-renewable resources. And it is important to note that these issues are not limited to developing economies; developed economies of the United States and Canada, currently face challenges in maintaining and deteriorating infrastructure.

Given that worldwide urbanization is accelerating, a significant challenge in sustaining infrastructure is at the city- and local-government level. All of the geospatial and non-geospatial information associated with infrastructure, cities today need a 3D City Geospatial Information System.

The mission of a 3D City GIS is to support decision processes in the creation and operation of urban infrastructure. This infrastructure is constructed such that it balances the need for growth, development, and the equally critical requirement for sustainability and a high quality of life for people's lives. A 3D City GIS can add value to the infrastructure project delivery process. By providing even visualization of future projects to more accurate and in-depth structure, 3D-rendered models enable a more-realistic view



The Benefits of a 3D City GIS for Sustaining City Infrastructure

The Challenges in Sustaining a City's Infrastructure

The design of new infrastructure and the management of as-built maintenance processes involve thousands of technical and human challenges. Obtaining and communicating the information required for analysis is only part of the complexity. Multi-disciplinary experts have to collaborate frequently on infrastructure projects. (For example, structural experts will focus on the mechanical properties of a building while energy assessors will focus on building energy design, analysis, and simulation.) In addition, many of these experts will have to communicate throughout the project with the general public and municipal leadership.

Challenges related to infrastructure sustainability are numerous, and their relationship to the global economy is important. In a study by Booz Allen Hamilton, the authors put the worldwide budget for infrastructure sustainability between the years 2005 and 2030 at 41 trillion dollars, with 50 percent of those dollars going toward water infrastructure. Given the large size of the expenditures anticipated, it's easy to see that even marginal productivity improvements in infrastructure sustainability will lead to significant savings in national budgets.

A better understanding of infrastructure usage can also provide tremendous benefits. For example, a highway alignment designed to minimize vehicle energy consumption can reduce a city's carbon footprint and, thus, help sustain the environment.



The city of Helsinki, Finland uses its 3D City GIS in a variety of workflows. These include several multi-departmental programs such as: soil survey, building permit processing, noise modeling, surface water flow modeling, and traffic simulation.

Given the large size of anticipated expenditure on infrastructure, it's easy to see that even marginal productivity improvements in infrastructure sustainability will lead to significant savings in national budgets.

The Benefits of a 3D City GIS for Sustaining City Infrastructure



Questions?

Thank You!

More information:

<http://www.bentley.com/en-US/Promo/Bentley+Map/>

www.bentley.com/DE/3DCityGIS

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