A2 - Bentley Map SS4 capabilities CityGML and 3D

Nordic Civil konference 07.11.2016 I Vejle

An introduction to working with CityGML and 3D objects

Bentley Advancing Infrastructure

Introduction

Johannes Klick

- Senior Support Manager
- Surveying Engineer and works since over 20 years in the Utility GIS Industry of which 15 years for Bentley
- Specialist in Utilities, responsible for managing and implementing Bentley Utility products like Bentley sisNET at customers.
- Manages the EMEA Application Engineer team who provide the Account and Product Advancement teams with mapping and utilities expertise; support Bentley's Asset Advancement Solutions, including BentleyOpenUtilities, Bentley Map, Mobile Apps, H&H, AssetWise Applications etc.

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3D City Models created in a Standard

OGC CityGML

CityGML is an open data model and XML-based format for the storage and exchange of virtual 3D city models. It is an application schema for the Geography Markup Language version 3.1.1 (GML3), the extendible international standard for spatial data exchange issued by the Open Geospatial Consortium (OGC) and the ISO TC211. The aim of the development of CityGML is to reach a common definition of the basic entities, attributes, and relations of a 3D city model. This is especially important with respect to the cost-effective sustainable maintenance of 3D city models, allowing the reuse of the same data in different application fields.

-www.opengeospatial.org

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LOD – Level of Detail

- Five Levels-of-Detail suitable to many different applications fields
- Every city object can be represented in each LOD simultaneously

Source: virtualCITYSYSTEMS, TU Delft

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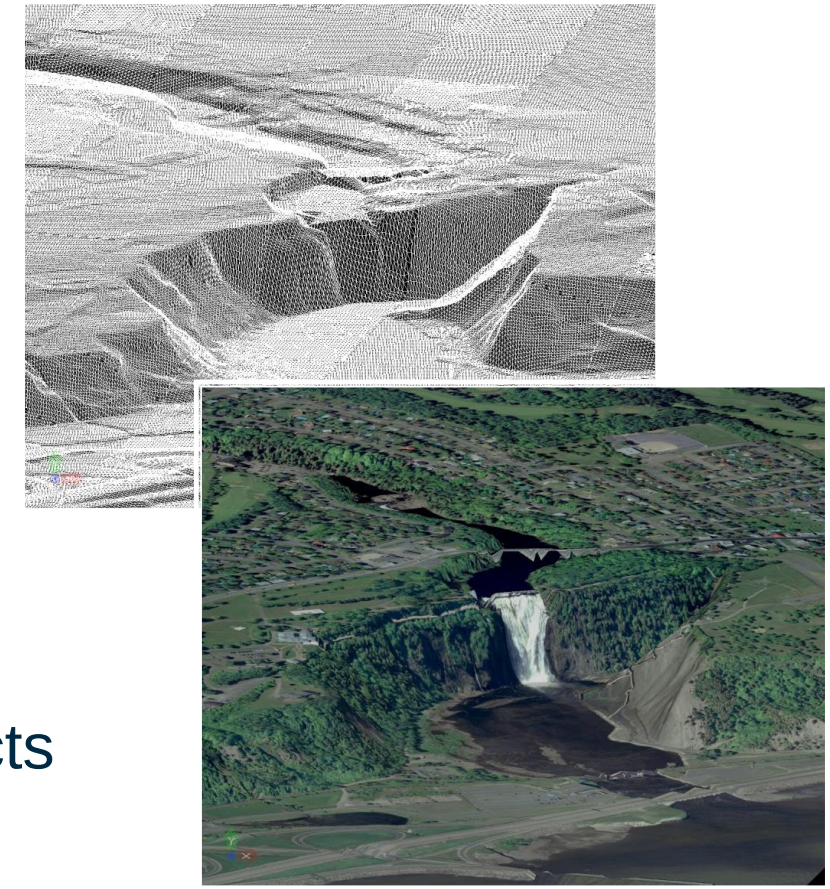
LOD 0 - Terrain Model *Land Use*

- Typical Uses
  - Road planning
  - Watershed Analysis
- Data Capture
  - Aerial LIDAR & Photogrammetry
- Software
  - Civil products: Sites/Projects
  - Bentley Descartes/Bentley Map Enterprise – Regions



Data provided by Quebec City and Images provided by Aero-Photo (1961) Inc, Quebec, Canada

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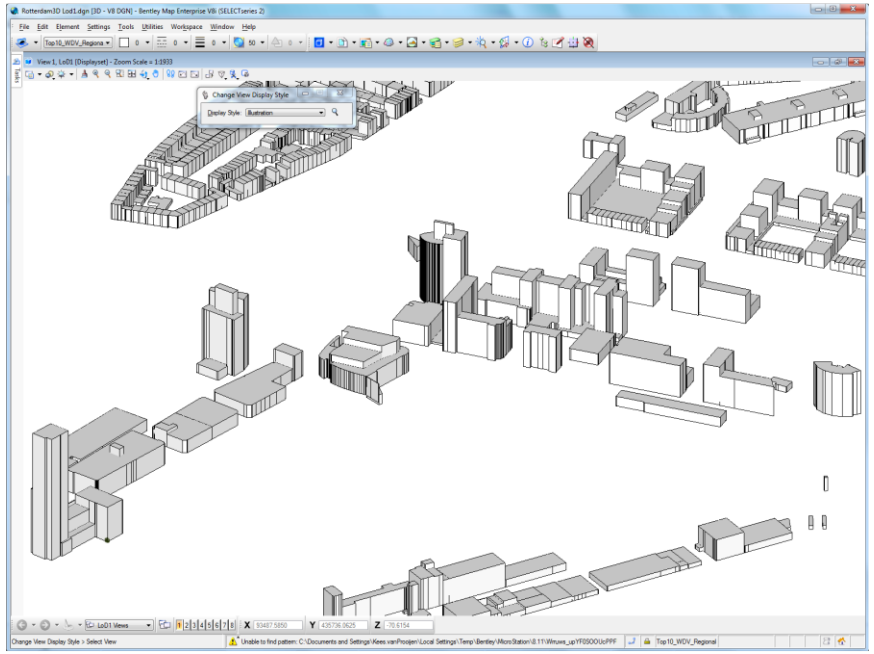
LOD 1 – City Model *Block models*

- Typical Uses
  - Project communication
  - Noise Analysis
  - Regional Solar Analysis
  - Shadow Analysis
- Capture
  - 2D to 3D conversion
  - Aerial LIDAR & Photogrammetry
- Software
  - Creation: Bentley Map
  - Management: Bentley Geospatial Server Oracle



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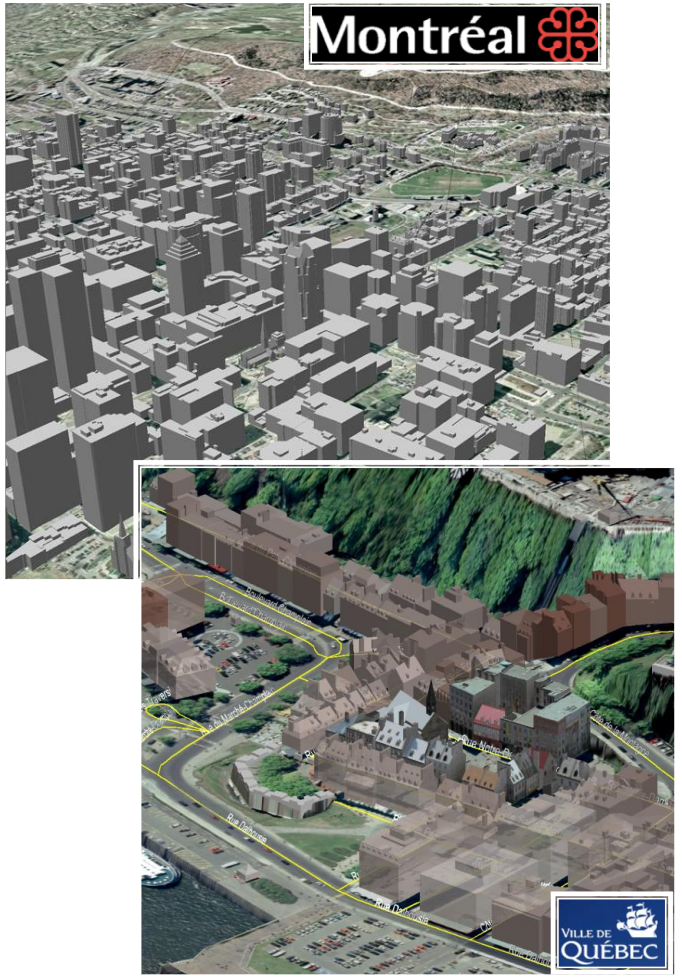
LOD 2 – City Model *Buildings: Simple Roofs & textures*

- Typical Uses
  - LOD 1 + Communicate project immediate surrounding, 3D Cadastre, Urban Planning, Natural Disaster, Tourism
- Data Capture
  - LOD 1 techniques
  - Field capture of pictures
- Software
  - LOD 1 software & Bentley Descartes Texture capabilities



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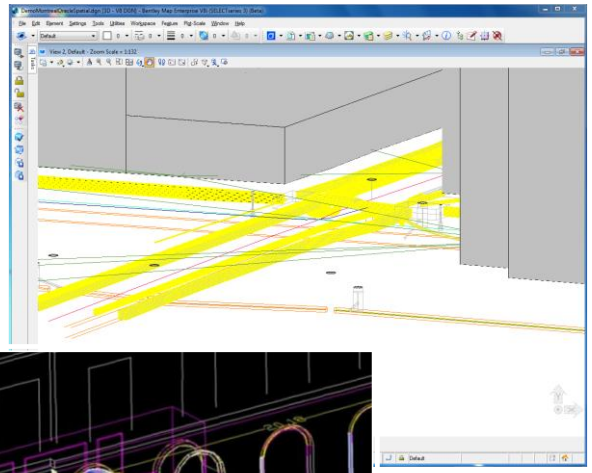
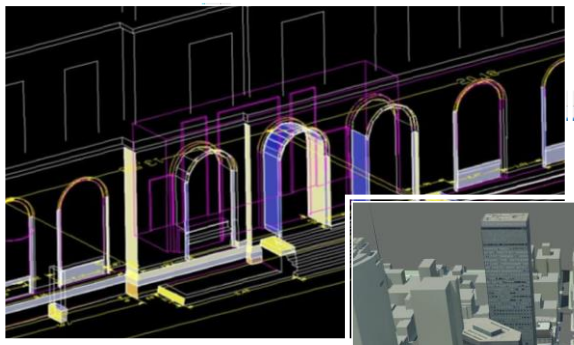
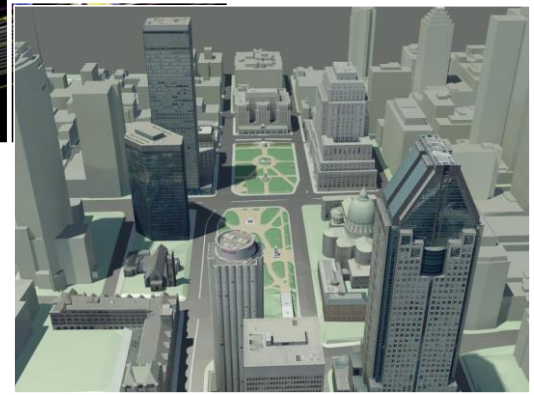
LOD 3- City Model *Facade details*

- Typical Uses
  - LOD 2
  - Civil Design & Facility Management
- Data Capture
  - LOD 2
  - High-density laser scanner
  - Traditional survey
  - GPR (*Ground Penetrating Radar)*
  - Pictures
- Software
  - LOD 2 software
  - Bentley Descartes V8i (SELECTseries 3)
  - Context Capture







Montréal

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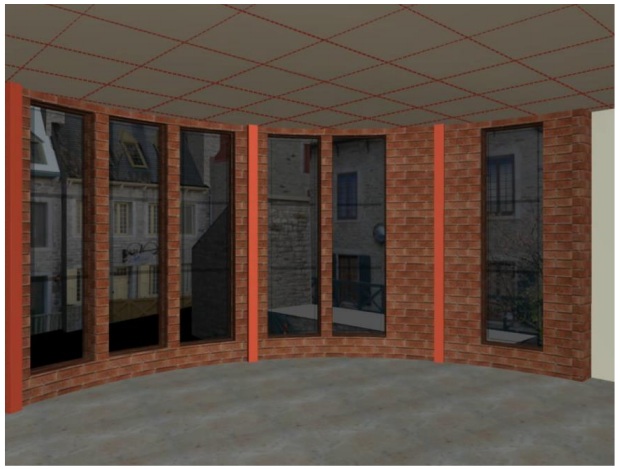
LOD 4 – City Model *Interior details*

- Typical Uses
  - LOD 3 +
  - indoor navigation
  - energy analysis
- Data Capture
  - LOD 3
  - BIM integration
- Software
  - LOD 3
  - AECOsim Building Designer



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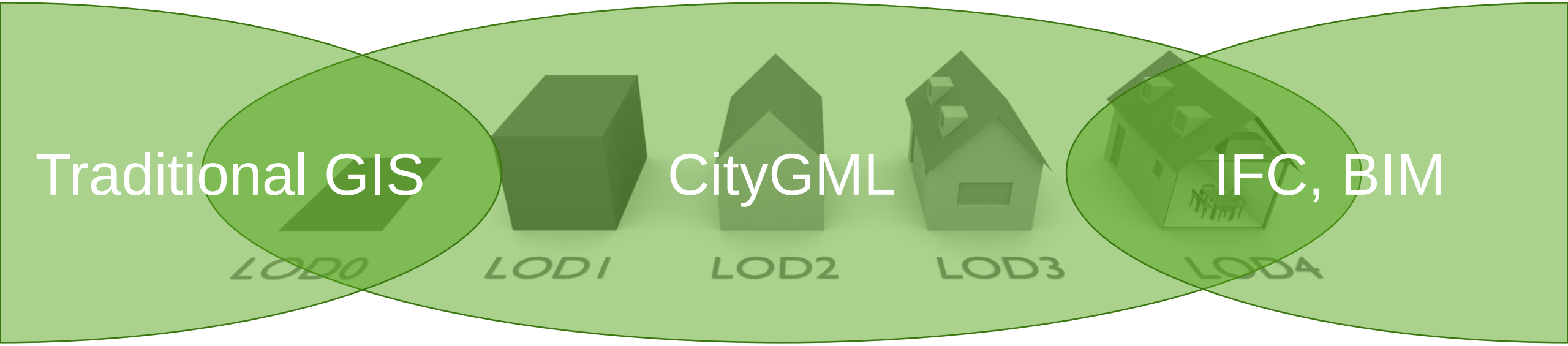
CityGML links different disciplines



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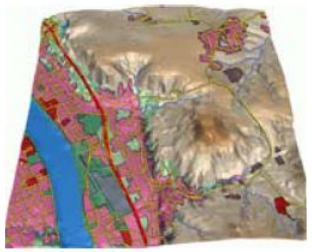
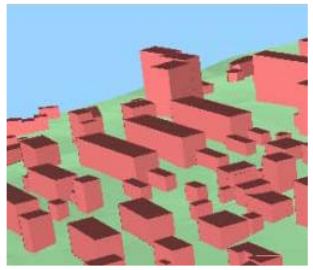
OGC CityML LOD (Level Of Detail) Definition



LOD 0

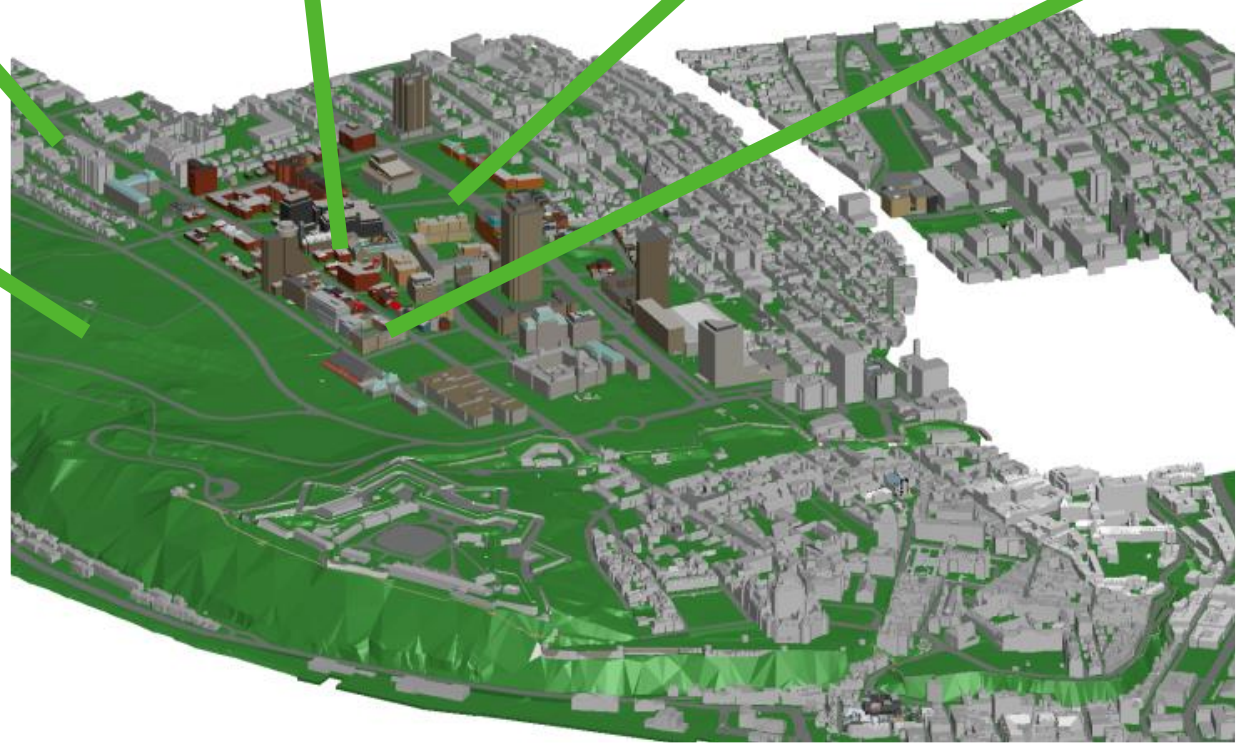


LOD 1

LOD 2

LOD 3

LOD 4



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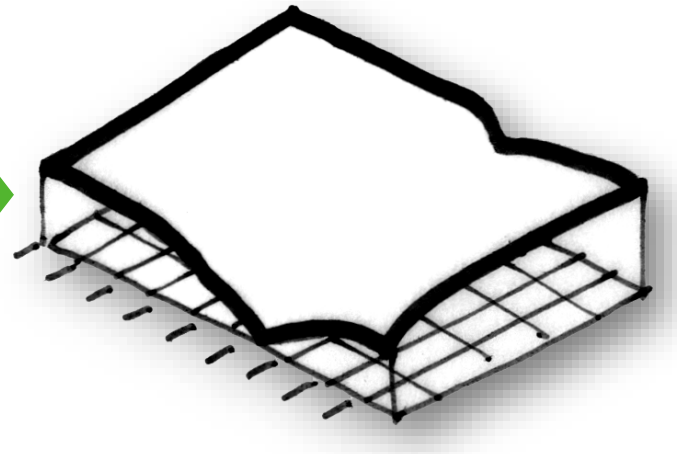
LOD 0

The Scalable Terrain Model(STM) is easily updated from the source documents.

- Civil DTM
- XYZ files
- DGN
- Raster DEM
- Point Cloud

On -Demand Regeneration

As the sources changes you can regenerate the STM.



STM

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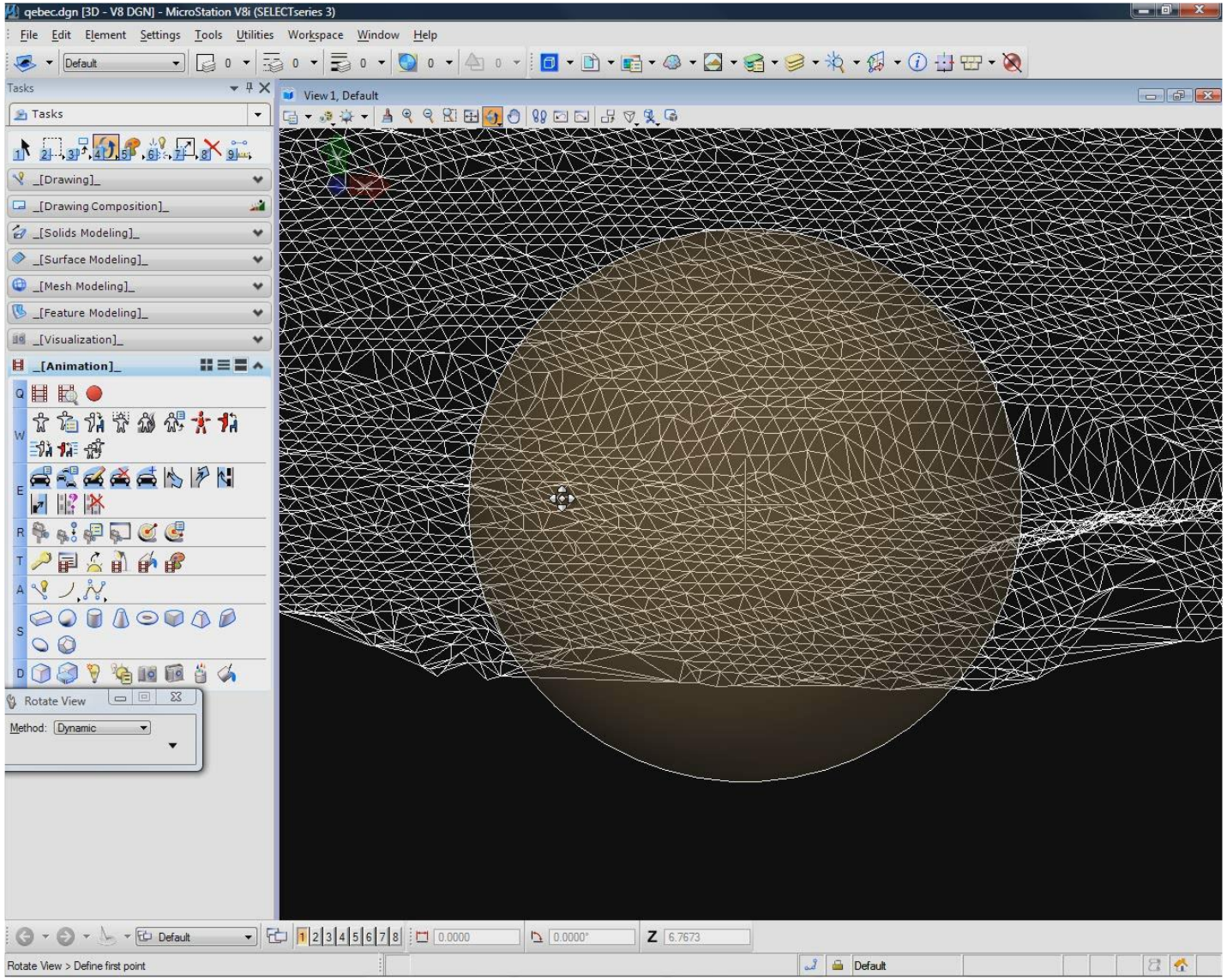
LOD 0



Scalable Terrain Model

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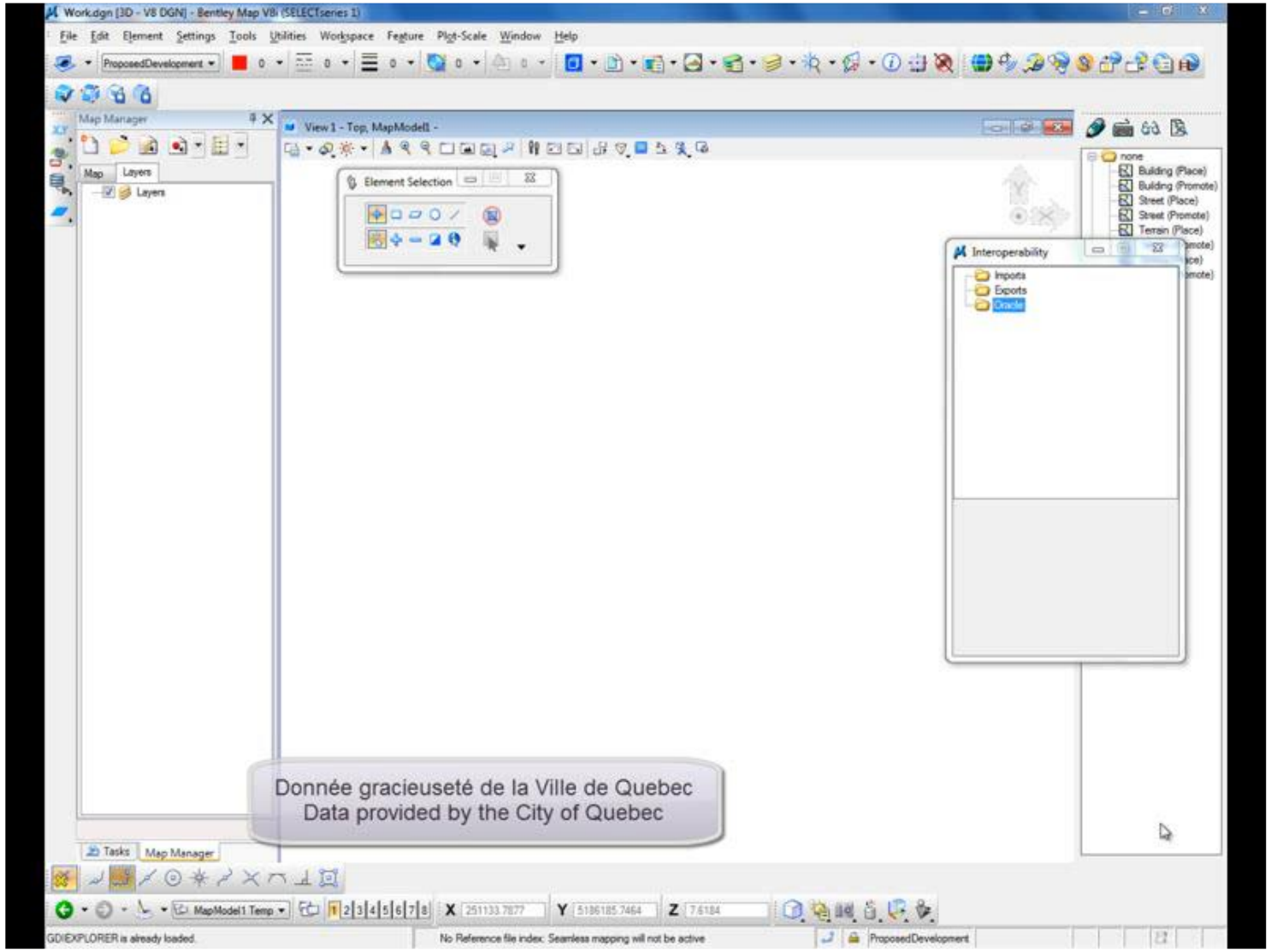
LOD 1



Use Oracle Spatial 3D

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LOD 1

Flood Analyses

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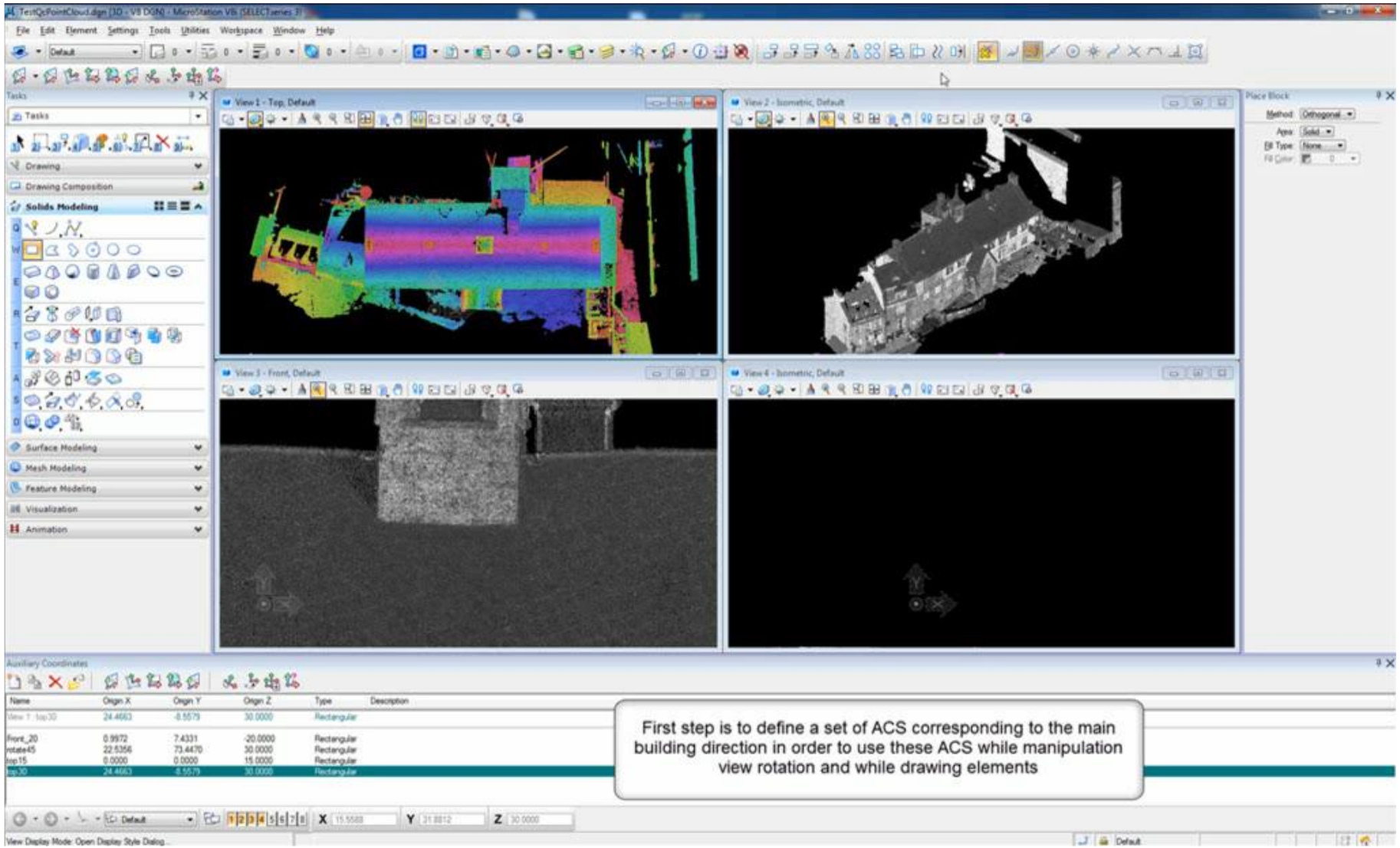
LOD 2



Create building from pointcloud

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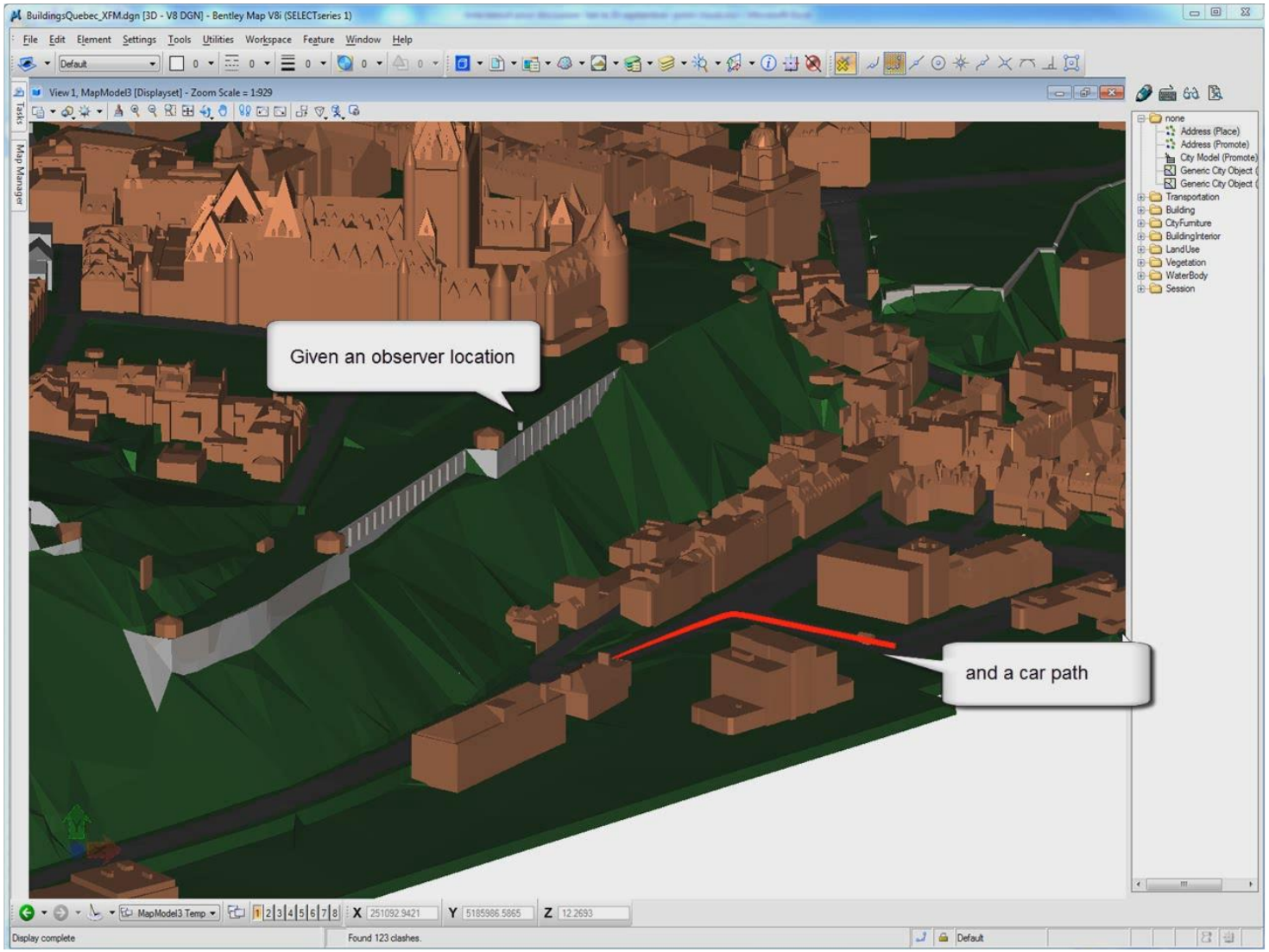
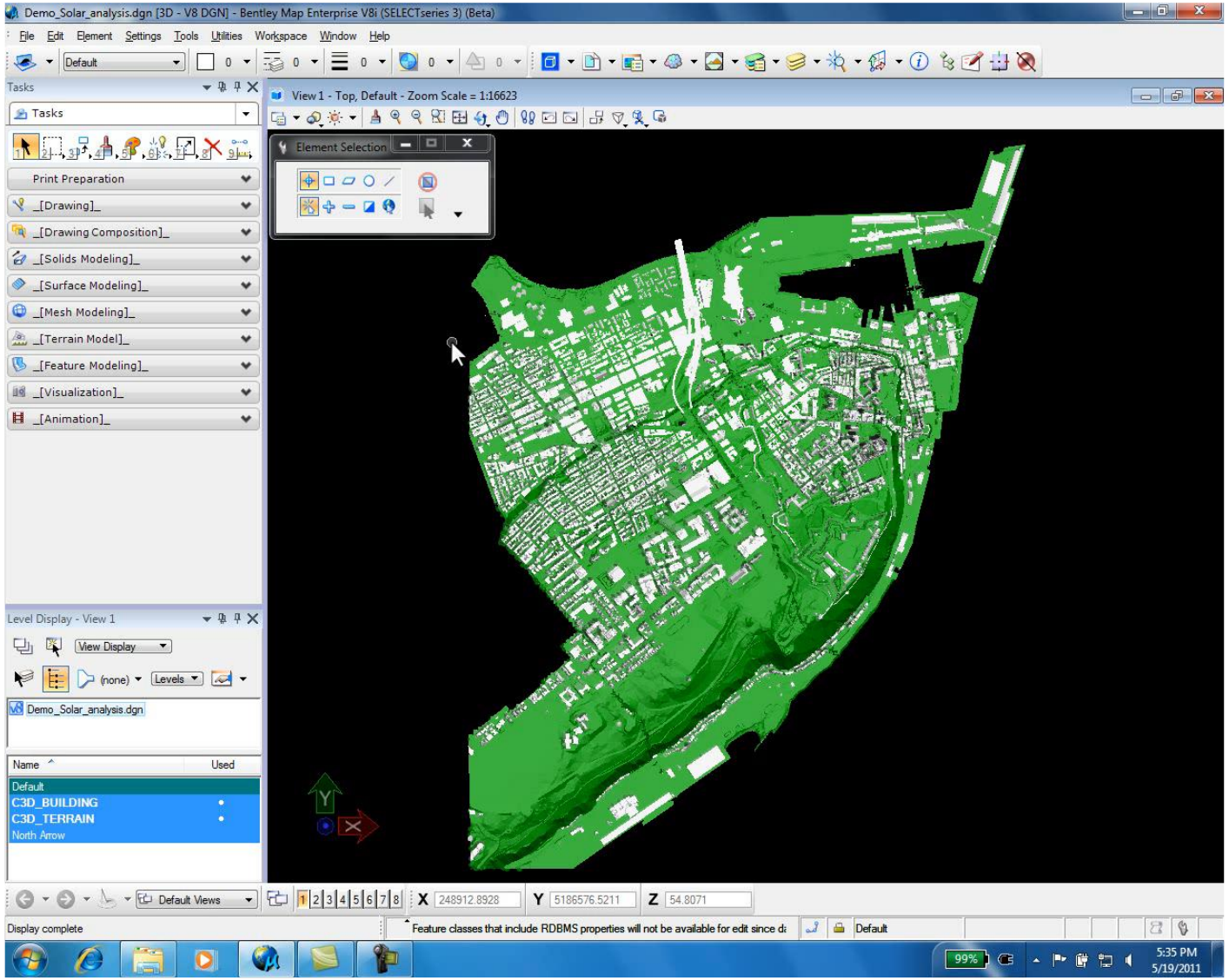
LOD 2



Line of sight analyses

LOD 2

Solar analyses



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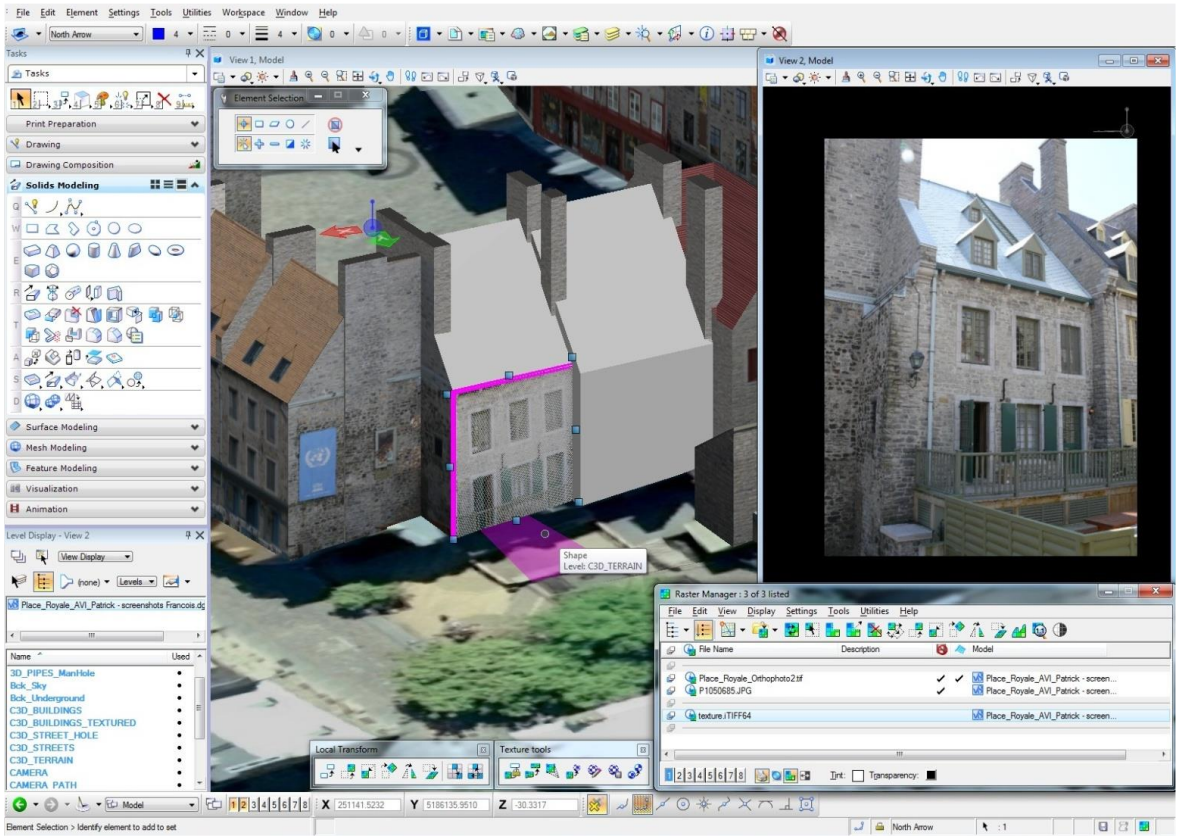
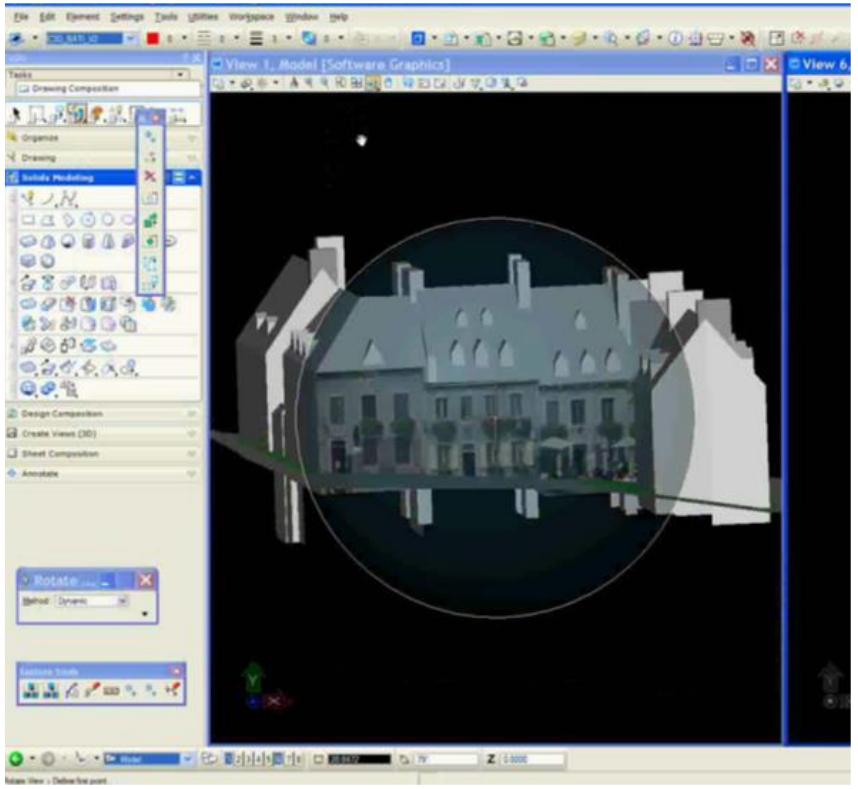
LOD 3



3D Texturing

- Intrinsic 3D
  - 3D Warp images
  - Create texture in 3D



Data provided by Quebec City, Canada

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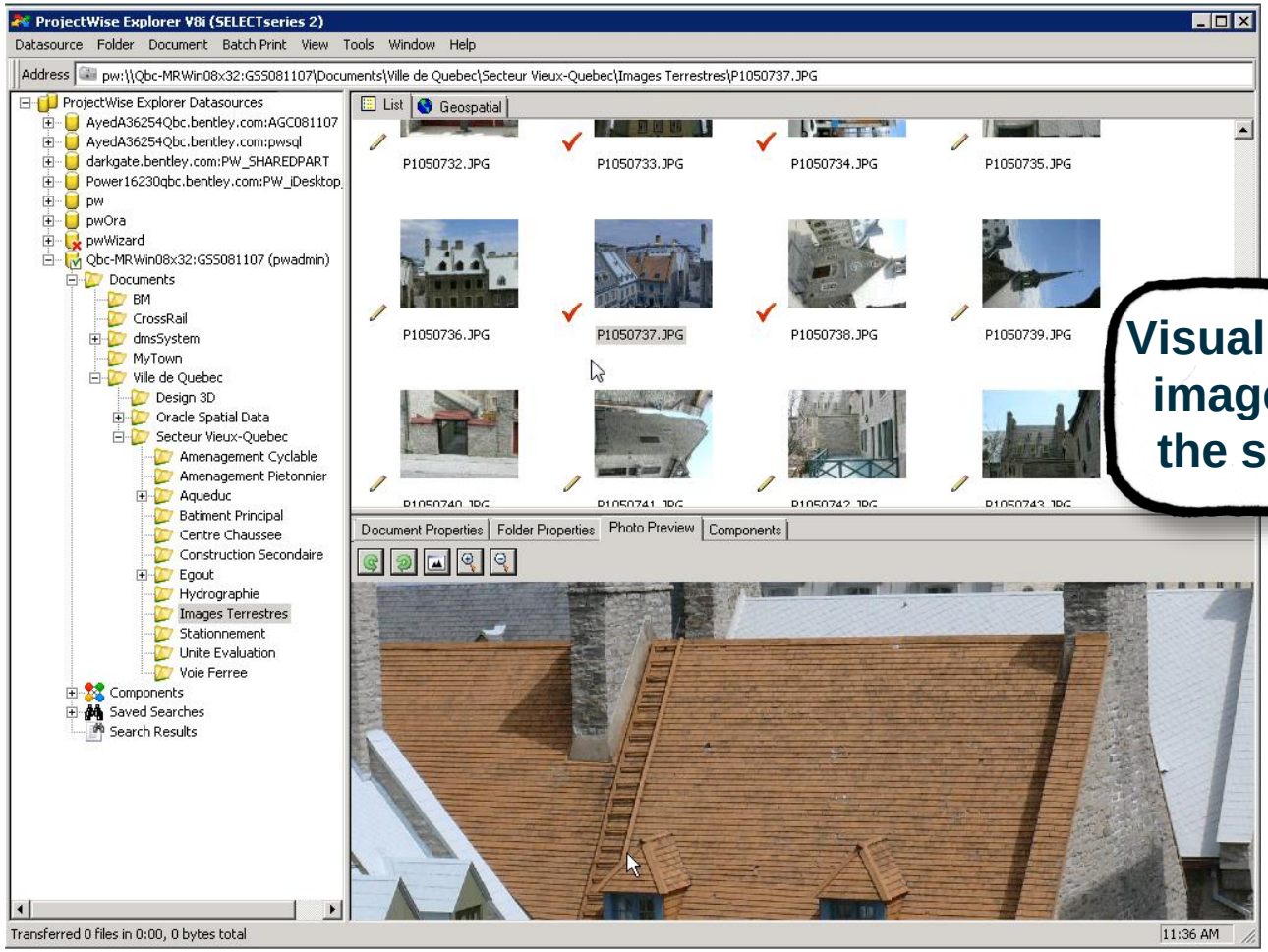
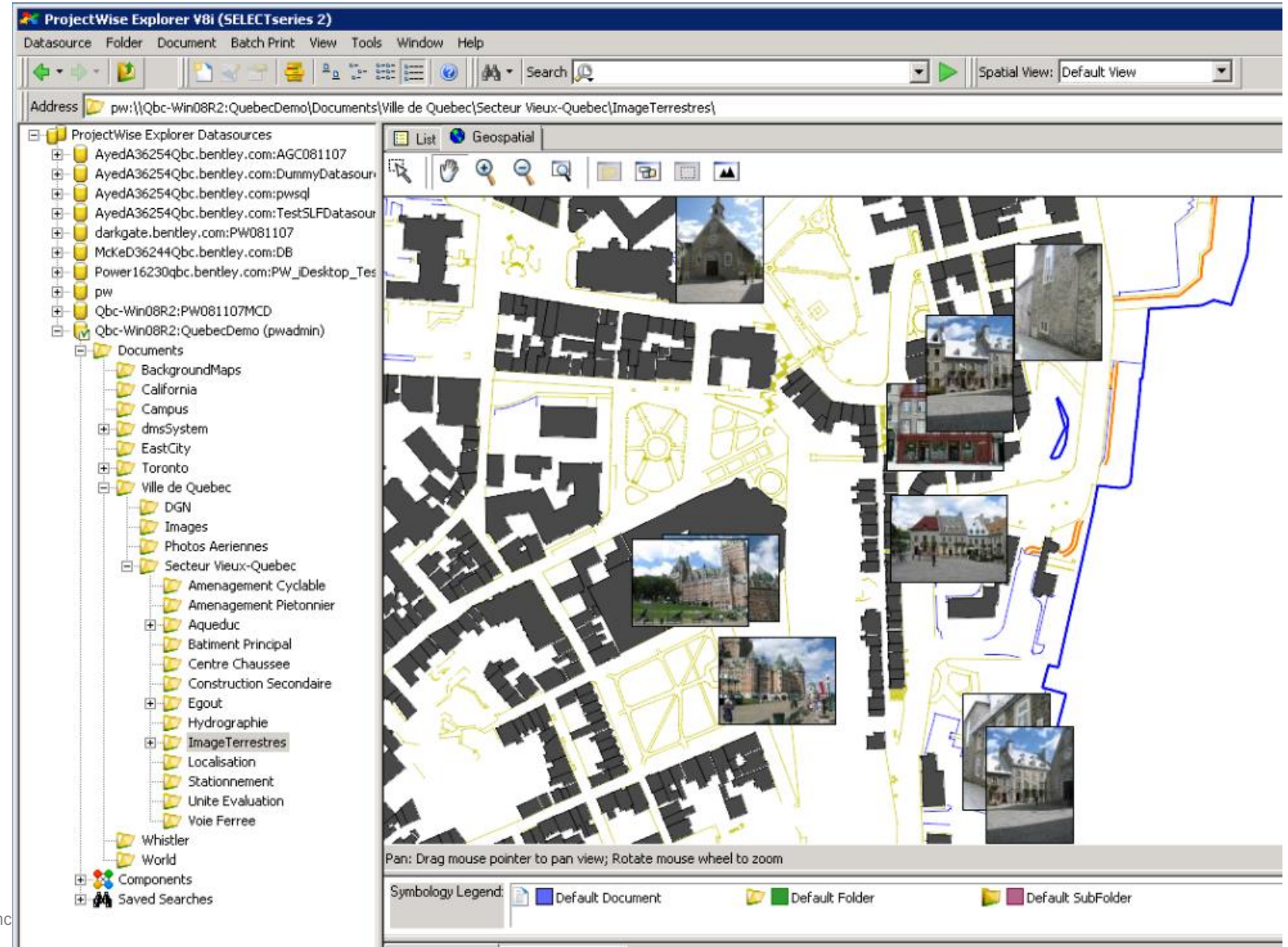
LOD 3

Manage and Serve



LOD3



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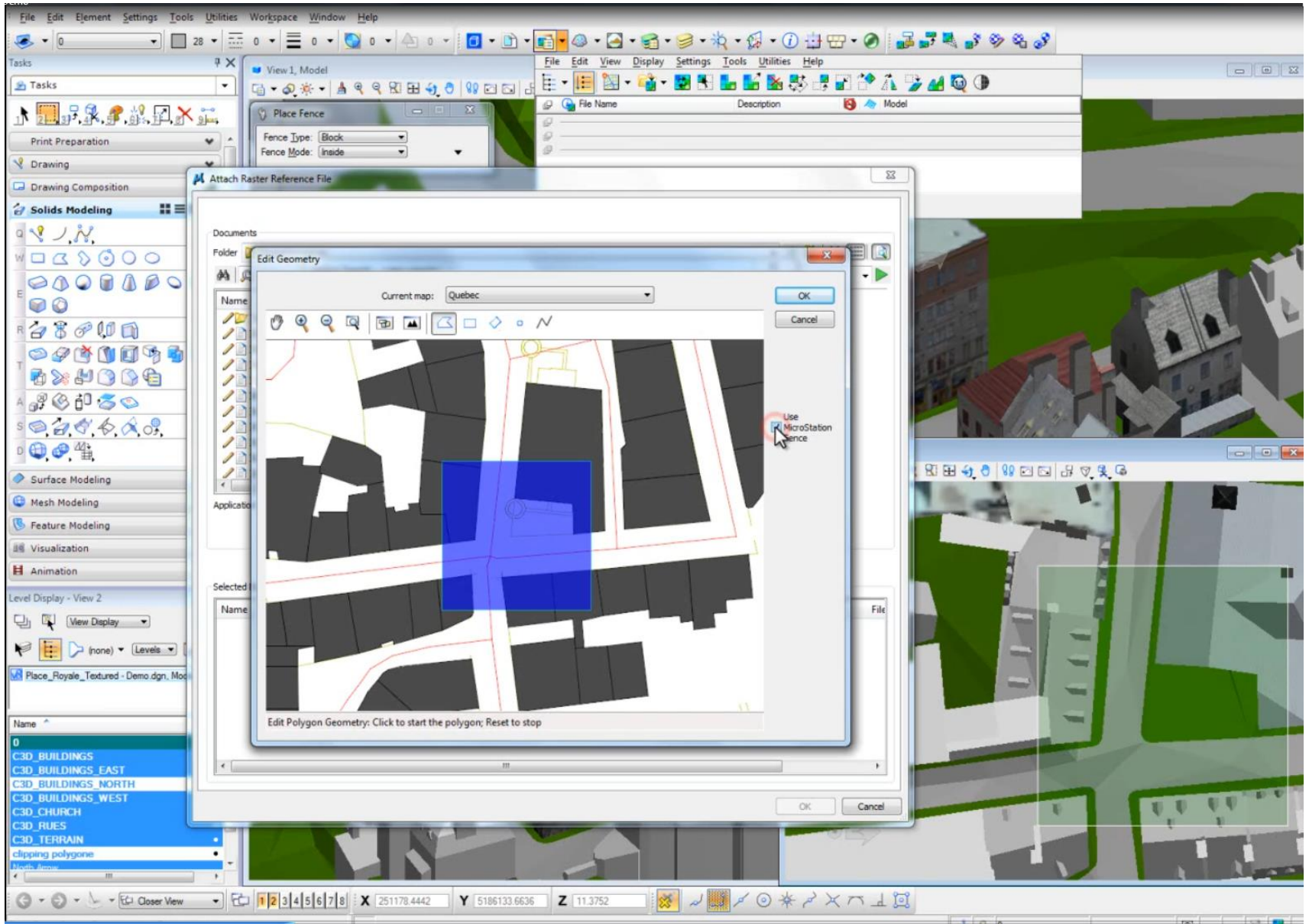
LOD 3



Search images to texture on the Geospatial Server

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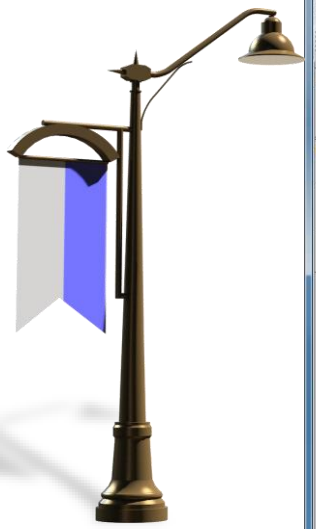
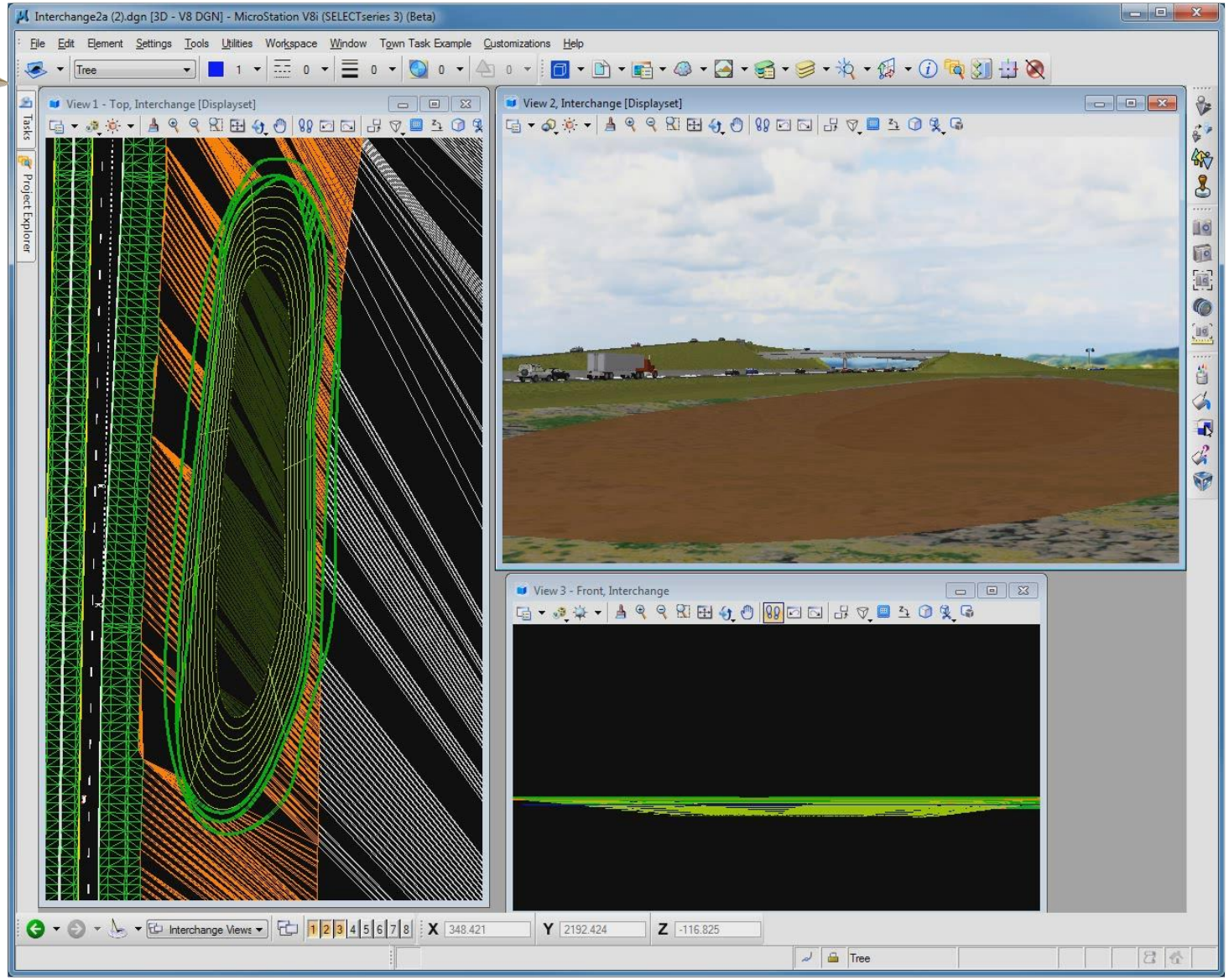
LOD 3





Populate Model

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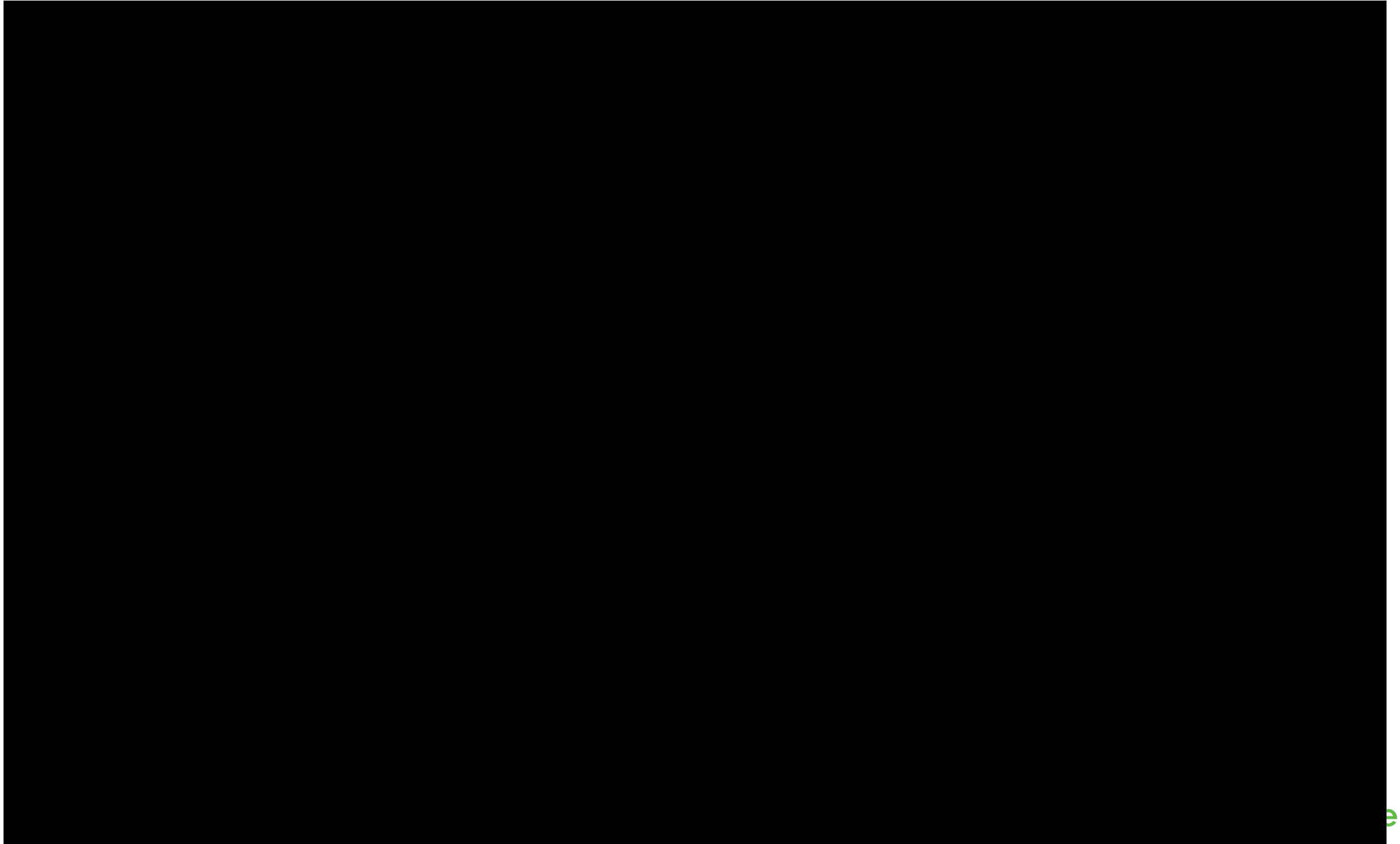
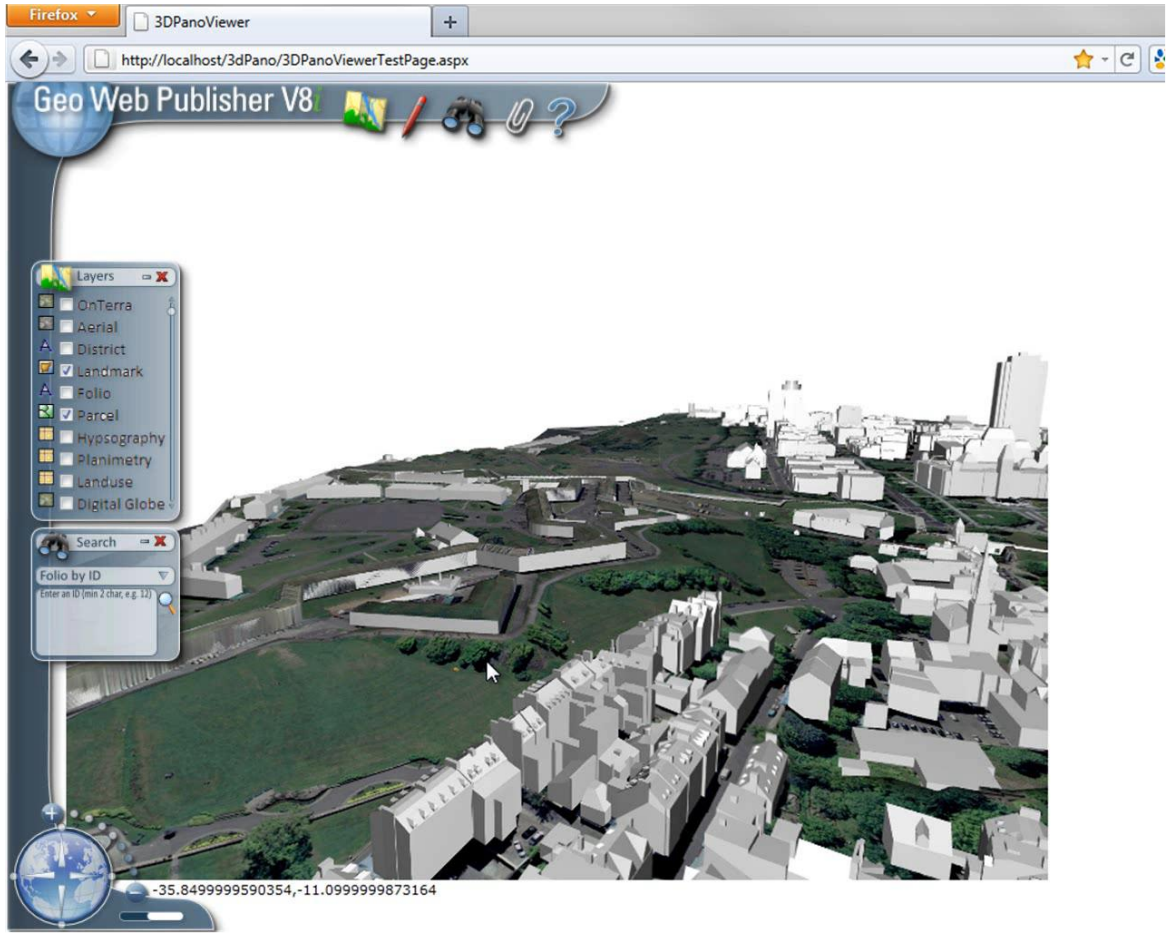


LOD 3



Publishing Virtual city for citizens

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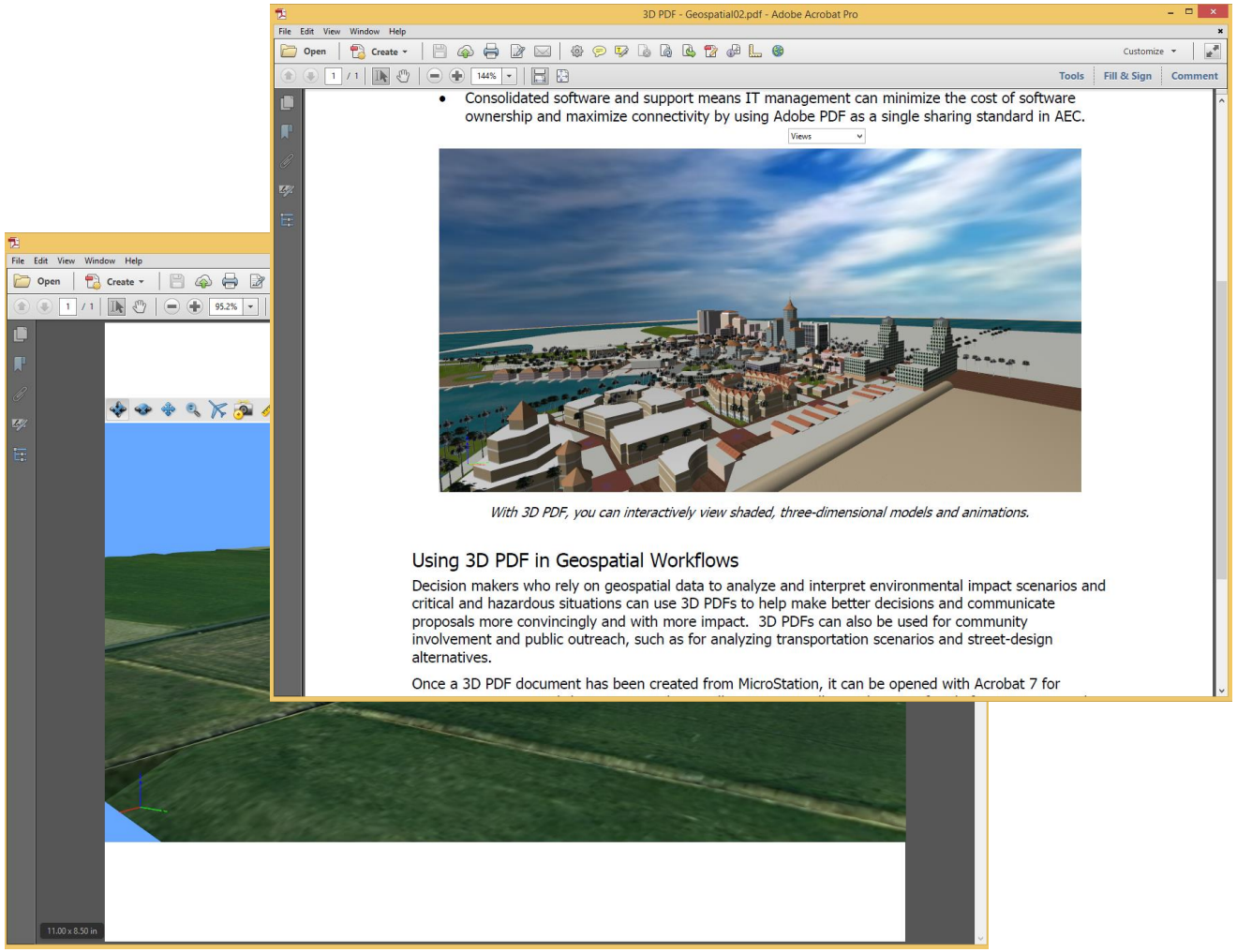
LOD 3

- Publish model properties directly to 3D PDF
- Share project specs with bidding contractors
- Deliver project status report to all stakeholders



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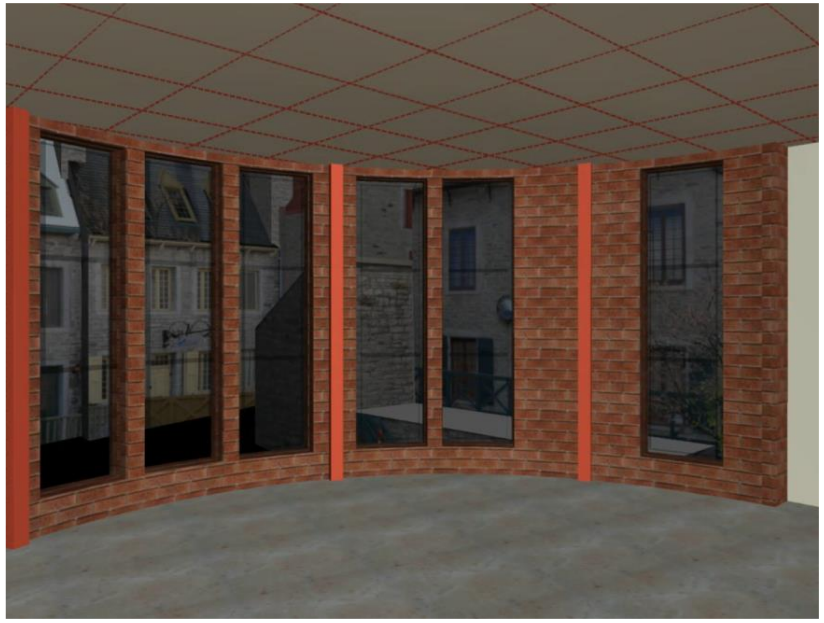
LOD 4

- Intrinsic 3D
  - 3D Warp images
  - Create texture in 3D



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Bentley Map V8i

Powerful, Extensible 3D GIS and Mapping Software for the World's Infrastructure.

- GIS functionality running directly on MicroStation
  - Engineering grade tools serving GIS
    - **Proven 3D capabilities** of MicroStation with the same familiar interface plus….
      - Attribute data captured automatically during placement
      - Connect directly to native Oracle Spatial/SQL Server Spatial or work in DGN
      - Long transactions and support for disconnected editing(Oracle)

- 2D and 3D integrated in a single environment
- Allows creating, updating and analyzing data (thematic mapping, overlays, reporting)

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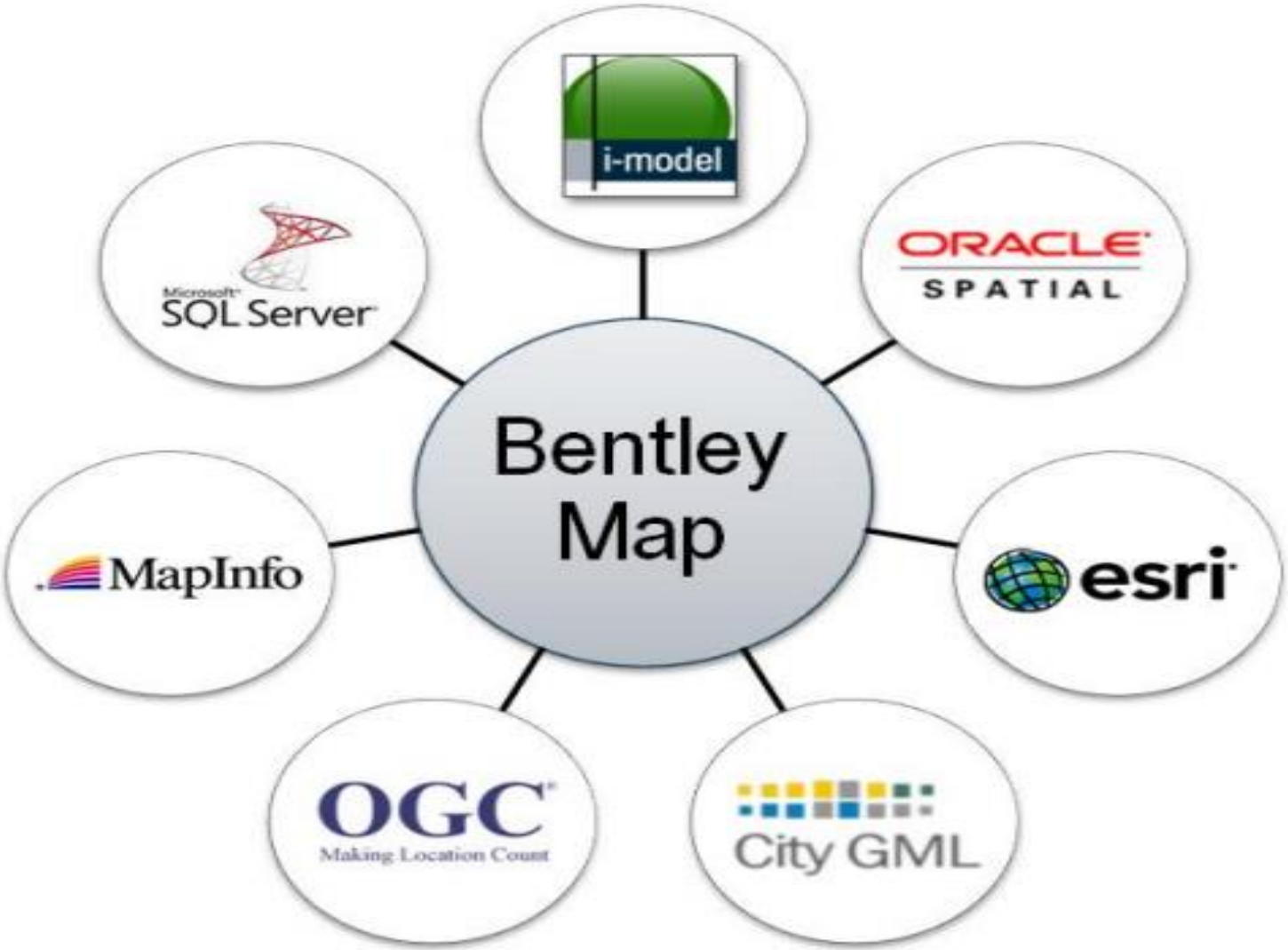
Interoperate & integrate in flexible architectures



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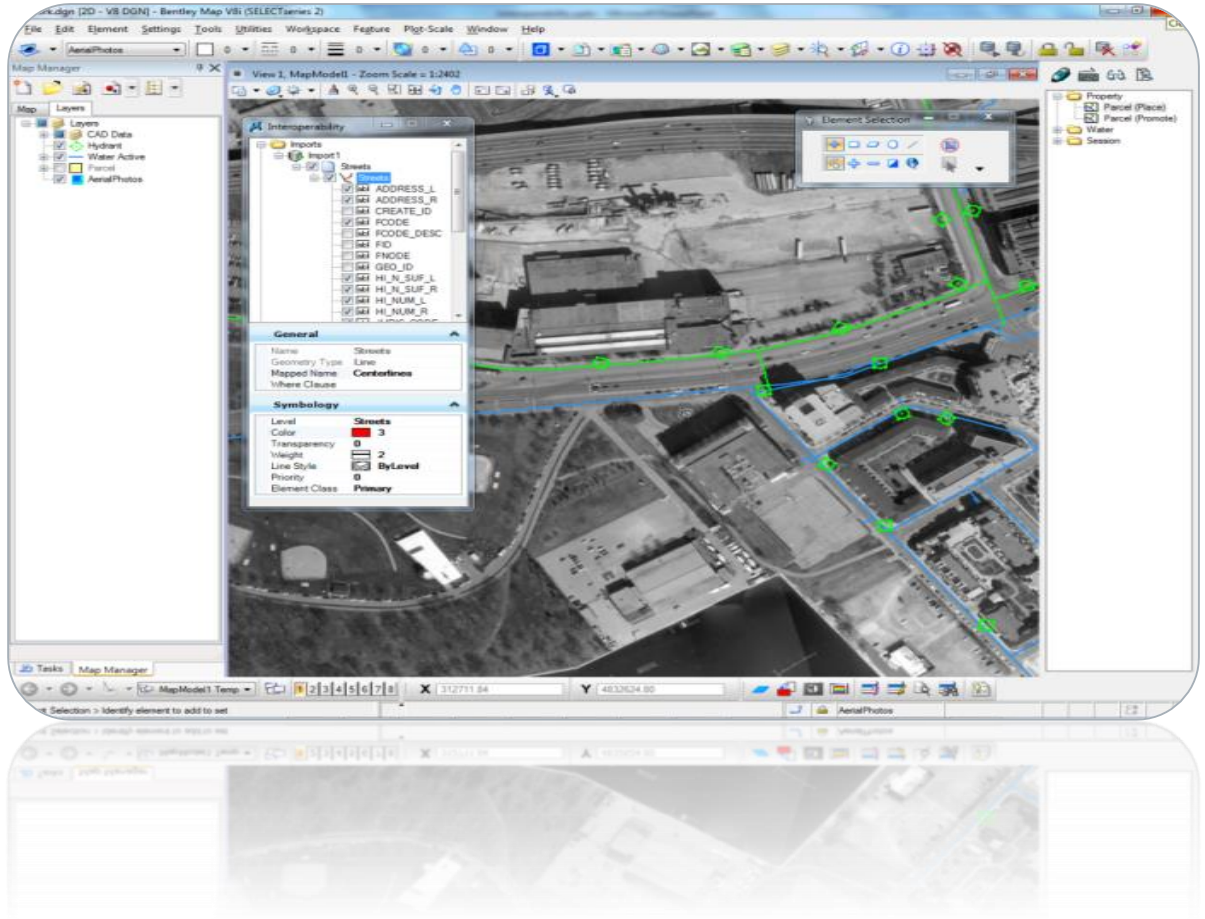
Bentley Map – Interoperability

- Import and export and directly reference a variety of common geospatial formats
  - Esri File Geodatabase, SHP, MapInfo, GML, CSV, ODBC, CityGML
- Assign symbology
- Save settings for reuse and bulk operations



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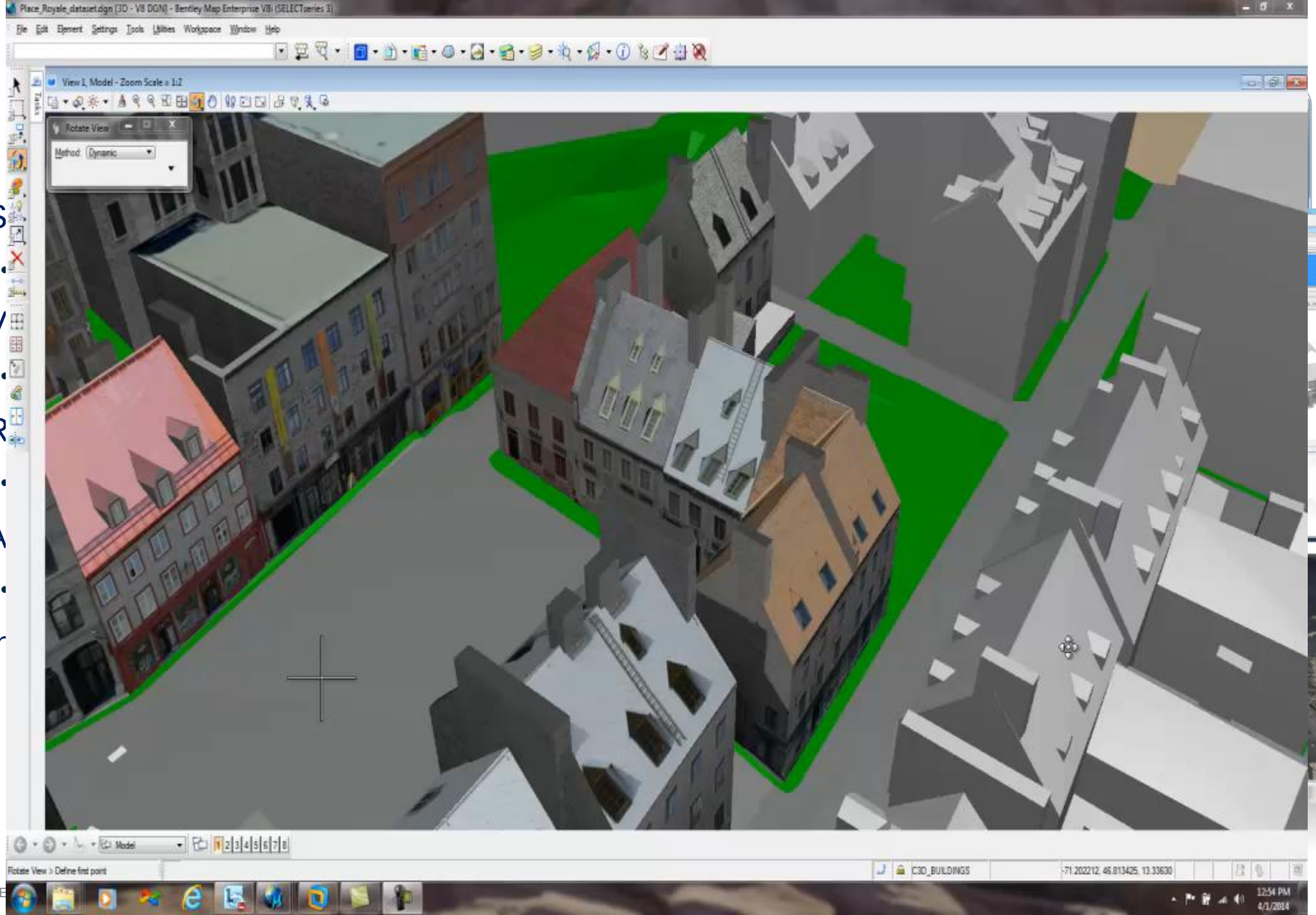
3D

- S
- V
- R
- A
- Ir



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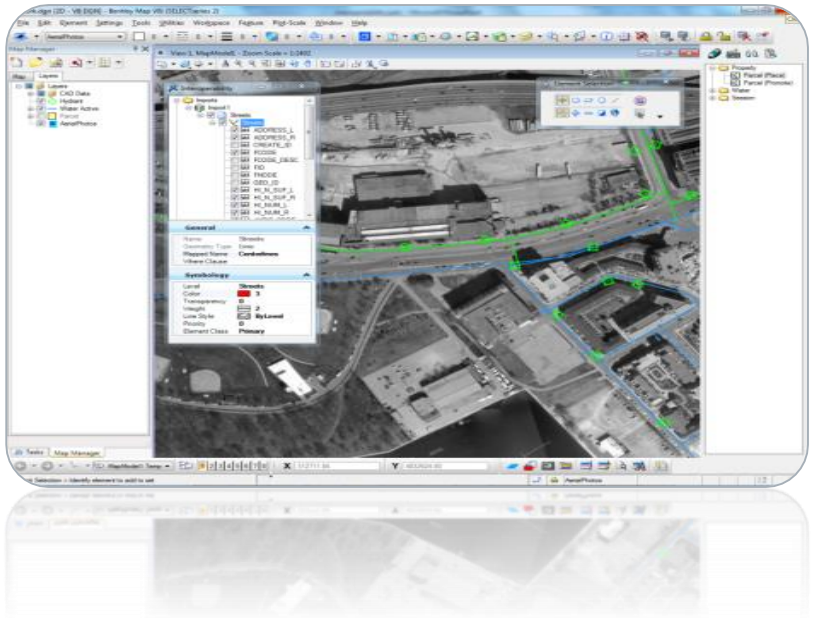
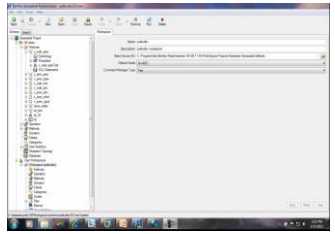
Bentley Map – Feature Modeling

- Add GIS intelligent properties to new AND legacy CAD graphics
- Drives the symbology/style and labels in CAD automatically (data driven graphics)

Automates User Standards in the same familiar MicroStation interface





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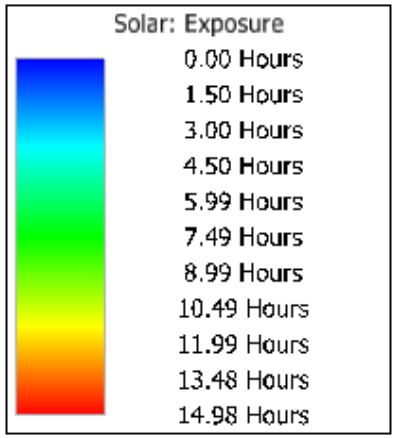
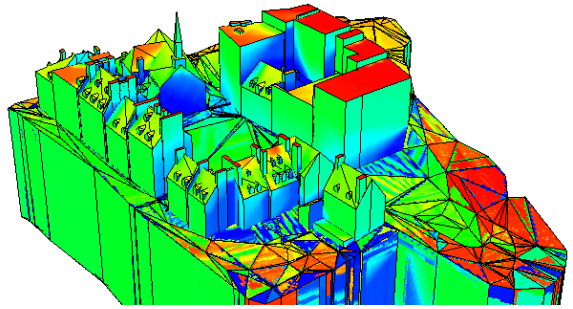
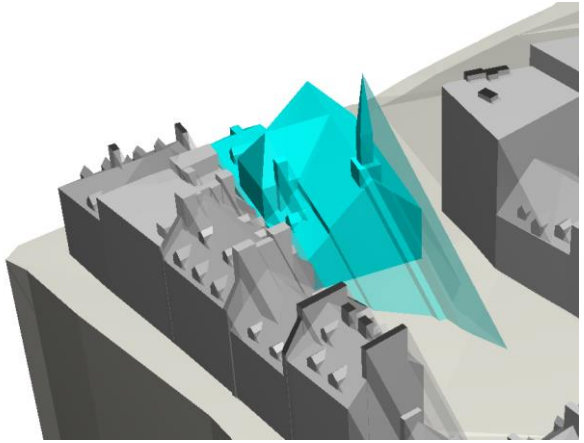
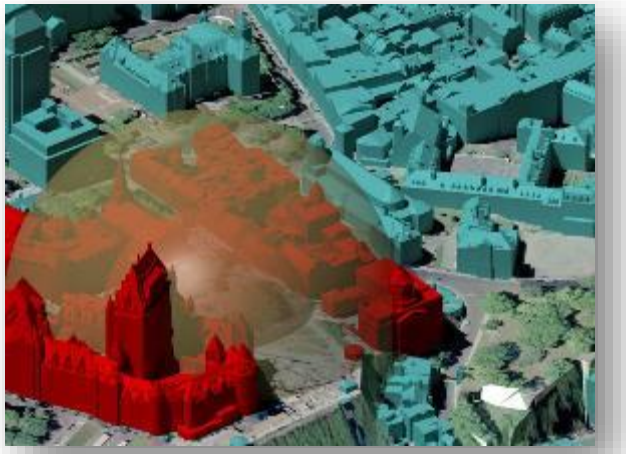
Bentley Map - Analysis

- ✓ Thematic 3D Model
- ✓ Shadow Analysis and Generator
- ✓ Solar Analysis and Generator
- ✓ Flood simulation
- ✓ 3D intersection









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Use Existing Data Models

Can also convert directly from an ESRI XML Workspace (eg. file GDB,shp etc)
or spatial database:

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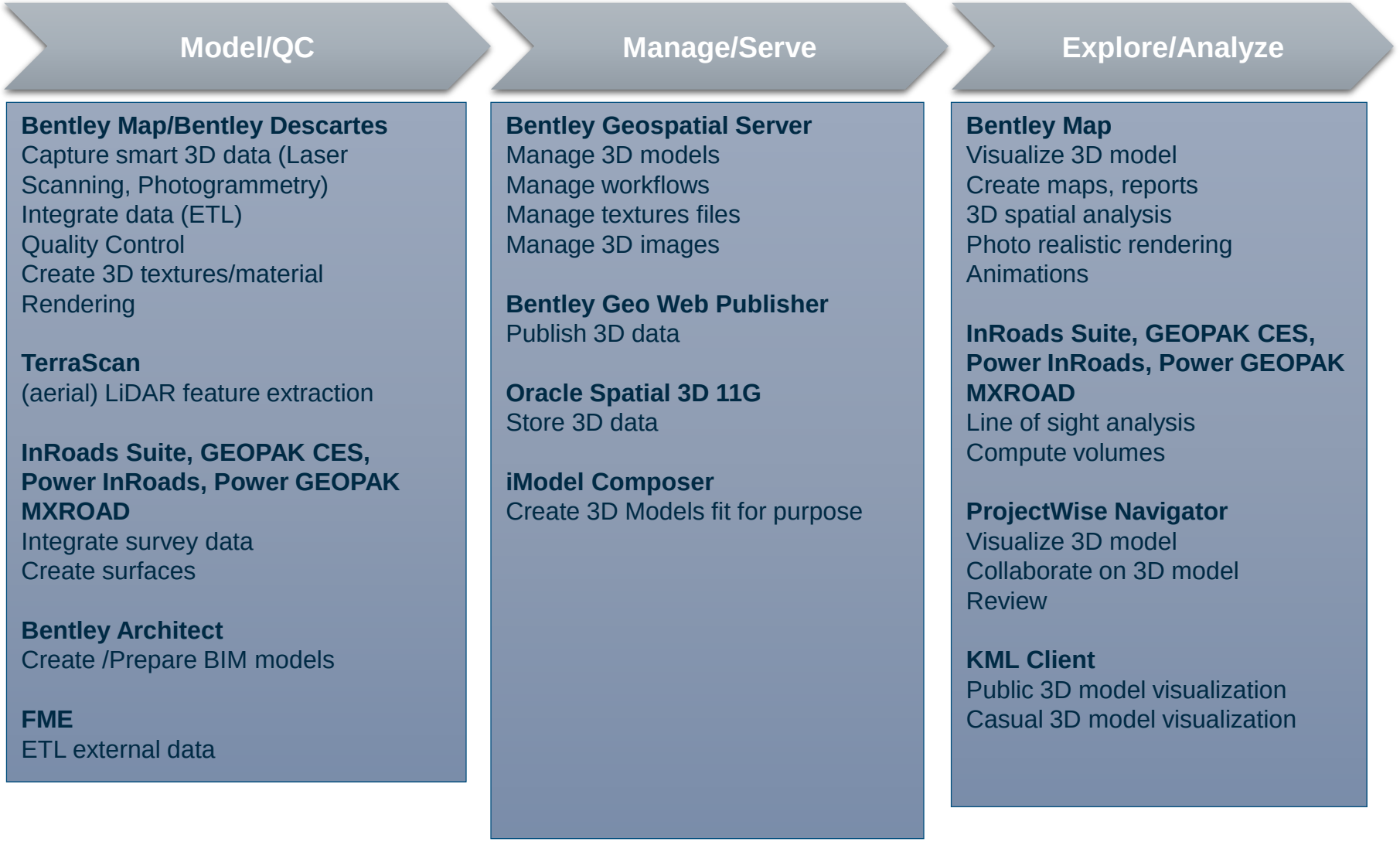
Workflow



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Benefits of Intelligent 3D City Models

- Enhanced communication via visualization

- Visualization – show how a new situation will look

Source: City of Eindhoven

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Benefits of Intelligent 3D City Models

Better plans

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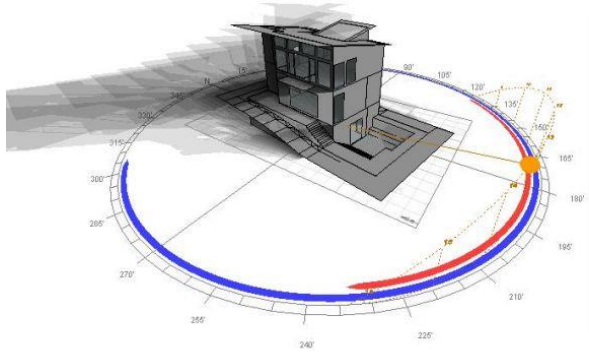
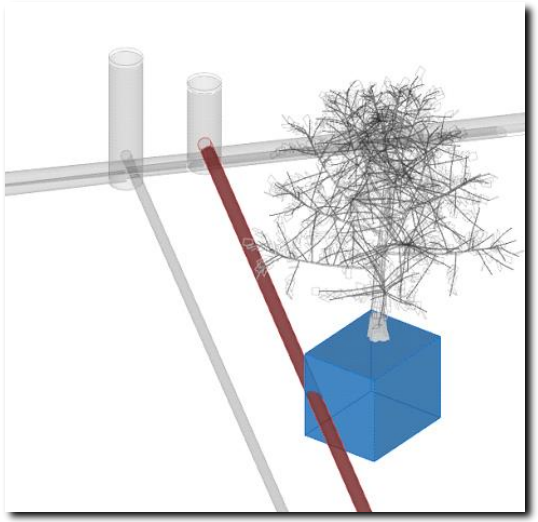
Benefits of Intelligent 3D City Models

Better analysis

- Shadow Analysis for historical site during the day time…
- The root system of a tree and a new sewer system interfere…



- Avoid errors during construction.
- Clash Detection.



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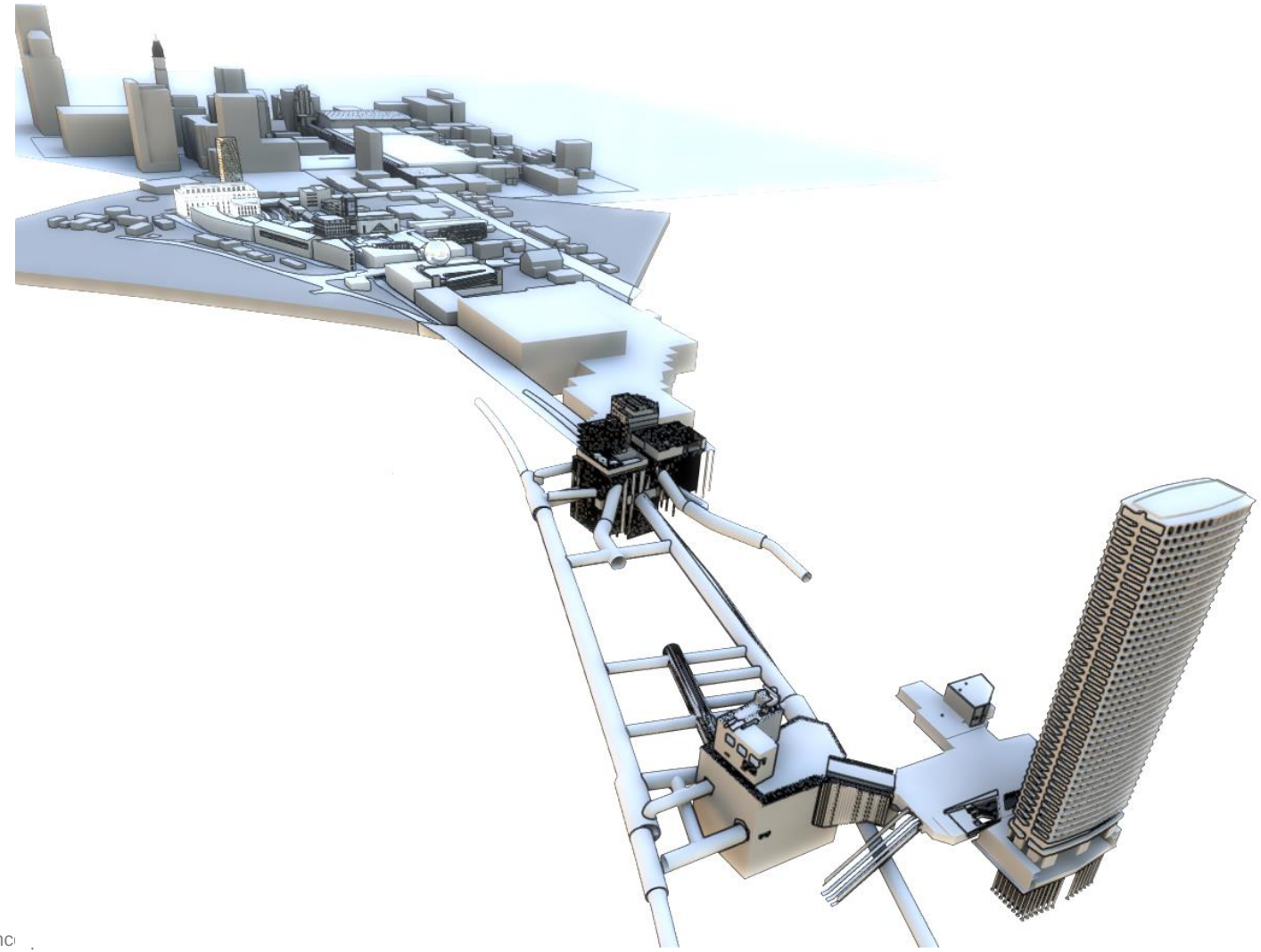
Benefits of Intelligent 3D City Models

More resilient cities



Success Stories

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City of Amsterdam, the Netherlands

IJburg

Gemeente Amsterdam
City of Amsterdam, the Netherlands

"The collaborative Bentley portfolio of solutions allows us to use workflows fo development, infrastructure design, road and rail track design, and much more to design new infrastructure and to model the cityscape in 3D."

"The breadth of Bentley's solutions for local government has allowed us to standardize citywide on Bentley geospatial and engineering technology."

Arjan Molenaar
Amsterdam's Physical Planning Department

Bentley

Bentley

IJburg

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Noise Analysis – City of Warsaw

Area	
- City	517 km^2 (199.6 sq mi)
- Metro	6,100.43 km^2 (2,355.4 sq mi)

Population (2009)	
- City	1 706 724
- Density	3,291/km^2 (8,523.7/sq mi)
- Metro	3,350,000
- Metro Density	549.19/km^2 (1,422.4/sq mi)

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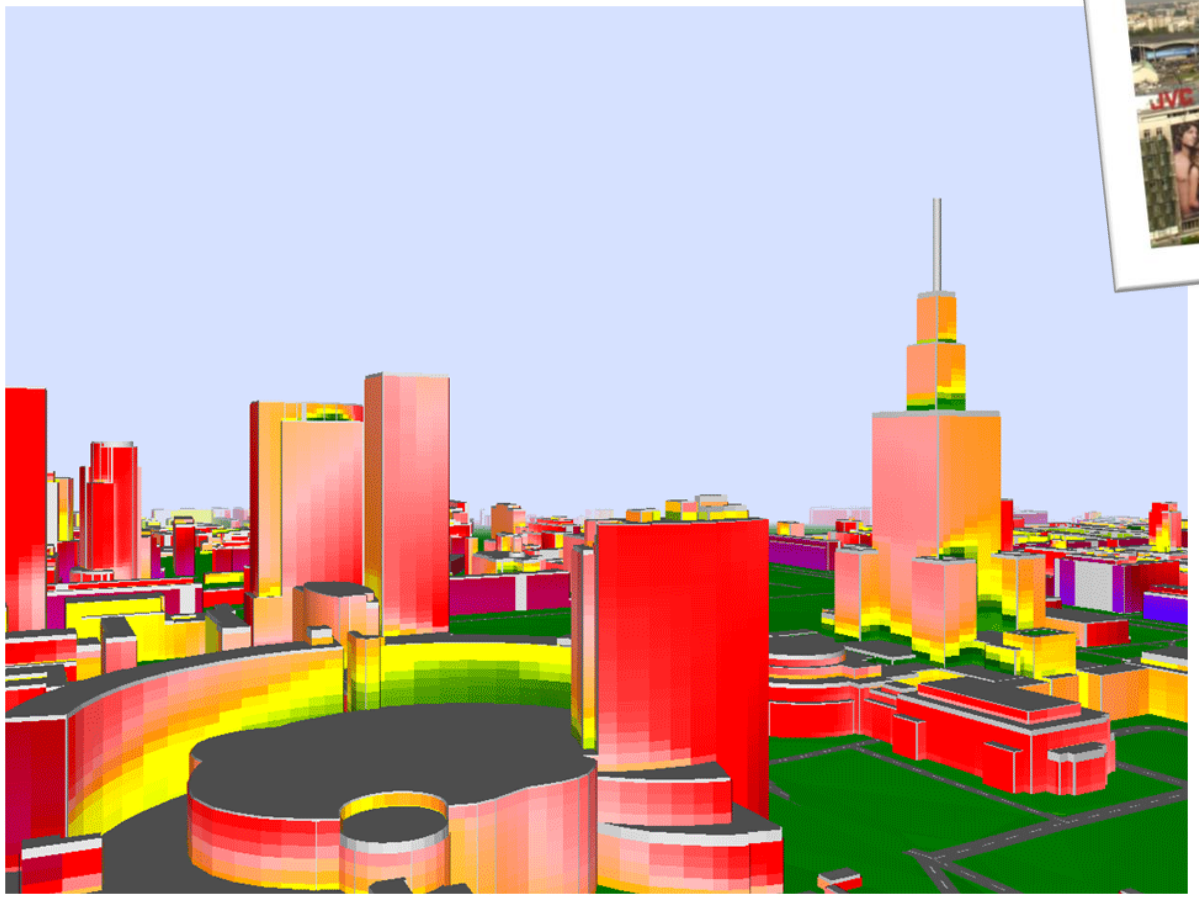
Noise Analysis – City of Warsaw



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City of Montreal

User:

Montreal City Geomatic Engineering Department

Project:

Managing an accurate and intelligent 3D City Model

Goal:

- Promote greater use of 3D geospatial data among all constituents
- Create accurate representations of city infrastructure using open and interoperable tools
- Leverage commercial of-the-shelf software for 3D city model maintenance
- Improve workflows associated with applying textures to 3D buildings

Area[1][2][3]	
- City	365.13 km² (140.98 sq mi)
- Urban	1,677 km² (647 sq mi)
- Metro	4,259 km² (1,644 sq mi)
Highest elevation	233 m (764 ft)
Lowest elevation	6 m (20 ft)
Population (2006)[1][2][3]	
- City	1,620,693 (2nd)
- Density	4,439/km² (11,496/sq mi)
- Urban	3,316,615
- Metro	3,635,571 (2nd)
- Metro density	854/km² (2,211.8/sq mi)
- Demonym	Montrealer (English), Montréalais / Montréalaise (French)

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City of Montreal

- City of Montreal – the 2nd largest urban area in Canada:
  - 3D model of the whole city
  - 3D engineering /urban planning
  - Accurate metadata
  - Oracle Spatial re… the water n…

*"**We are currently using Bentley Map for documenting the City of Montreal's water network and are extremely pleased with the productivity the product is providing us**. The Bentley Map feature engine allows us to easily create smart infrastructure objects, and we are able to create customized tools to improve data quality".*

Commenting on his organization's deployment of Bentley Map,
Jean Pellerin | Quebec land surveyor, City of Montreal

Bentley's Geospatial Products:
- Bentley Geospatial Server
- Bentley Map
- Bentley Descartes

Bentley

City of Helsinki

User:

Helsinki City Survey Division

Project:

From 2D to Accurate 3D Model

Goal:

- create a citywide 3D model supplementing older 2D basemaps for urban planning, civil engineering projects, soil surveys, building permit processes and more

Background of Helsinki City Survey Division:

- 142 employees with 40 employees work for GIS
- Responsibilities for all city mapping functions, including:
  - Maintaining a geodetic network, basemap and utility map 1:500, legal maps for city planning, topographic maps, and tourist maps.
  - Maintaining the legal parcel cadastre and surveys, parcel IDs, building IDs, aerial photography, parcel addresses and updates.
  - Maintaining the city's Web GIS services.
  - GIS coordination.

Area (2009-01-01)[1]	
- City	715.55 km² (276.3 sq mi)
- Land	213 km² (82.2 sq mi)
- Water	502.55 km² (194 sq mi)
- Urban	769.48 km² (297.1 sq mi)
- Metro	2,969.54 km² (1,146.5 sq mi)
Population (2009-06-30)[2]	
- City	579,016
- Density	2,718.38/km² (7,040.6/sq mi)
- Urban	1,027,635
- Urban Density	1,335.49/km² (3,458.9/sq mi)
- Metro	1,303,126
- Metro Density	438.83/km² (1,136.6/sq mi)
- Demonym	helsinkiläinen (Finnish), helsingforsare (Swedish)

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Users of 3D model:

- City Planning
- Public Works
- Helsinki Energy, Gas and Water departments
- Helsinki Harbour
- Public Transportation Authority

Usage of 3D model:

- city and street planning
- civil engineering projects
- soil surveys
- building permit processes
- noise modeling
- traffic simulation
- military defense applications

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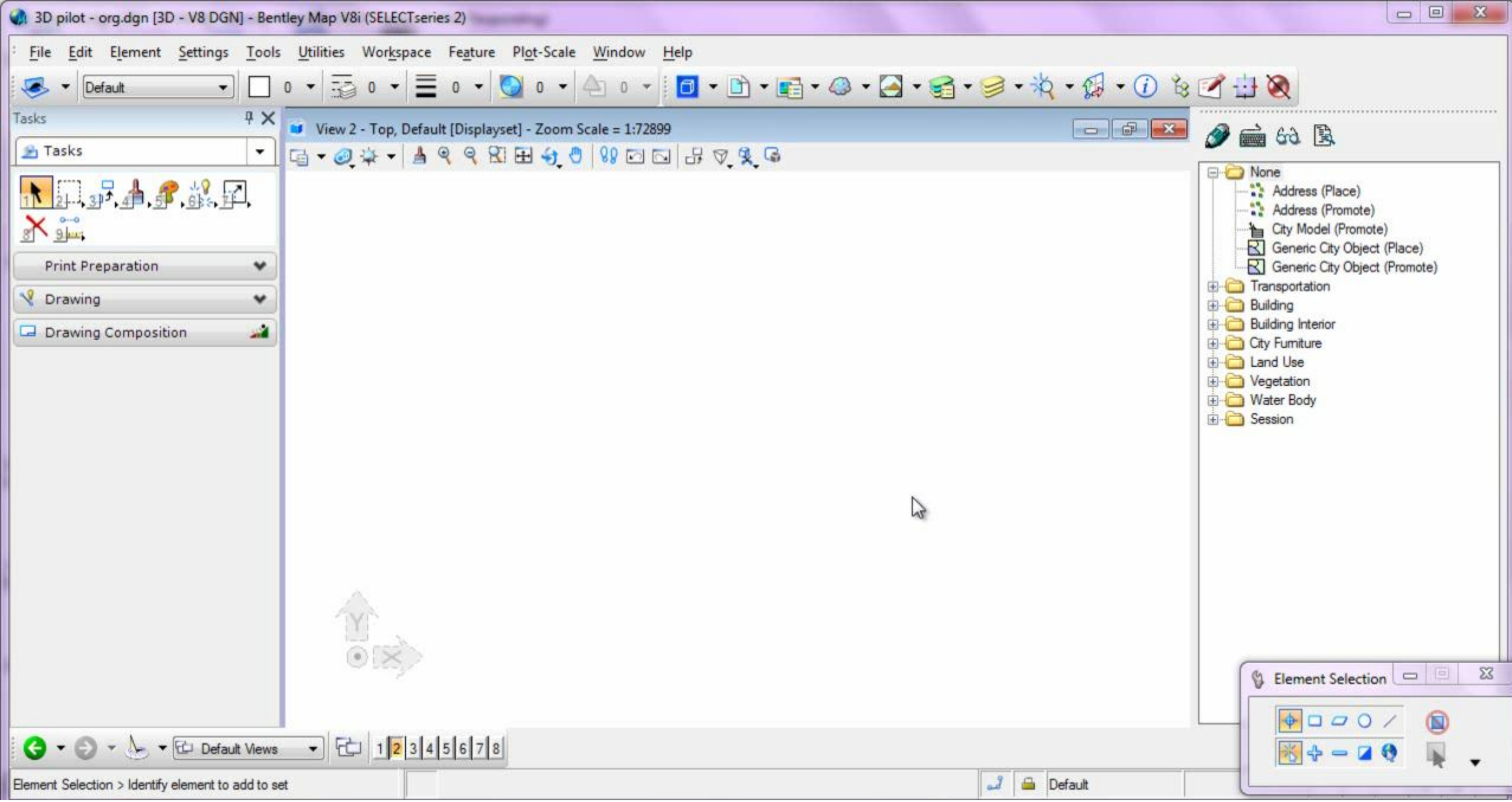

Thank’s for your attention !

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Sustaining Infrastructure

Advancing Reality Modeling

with Acute3D solutions