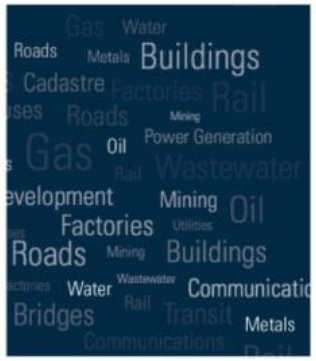
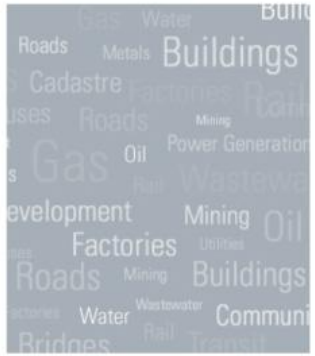
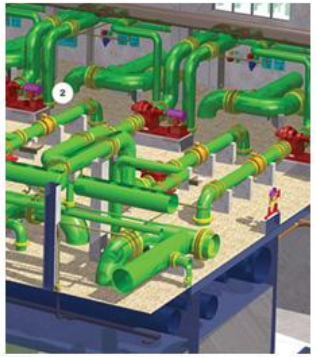







Bentley Systems
3D Urban Modeling

Peter Byrn, Chartered Surveyor
Transport and Local Infrastructure

Bentley
Sustaining Infrastructure

Agenda

Hot News

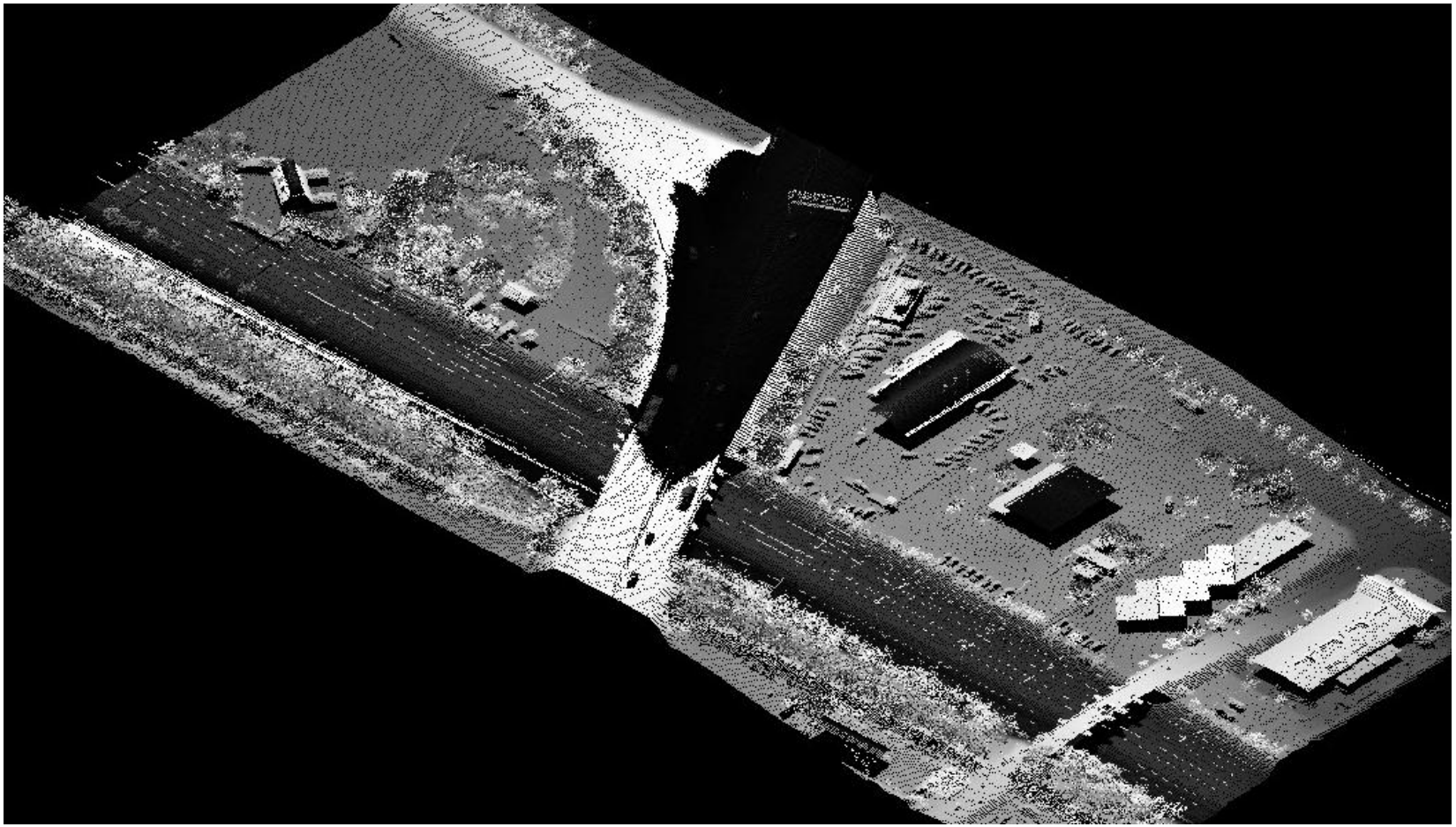
3D City & Urban Modeling in MicroStation environment
– Bentleys approach

Hot news

- Bentley Incorporates Point Clouds as an Integrated Data Type
- Bentley have announced a partnership with Pointools to include their Vortex Engine API into the Bentley platform. This integration will allow users to reference and manage point cloud data within MicroStation for better project management

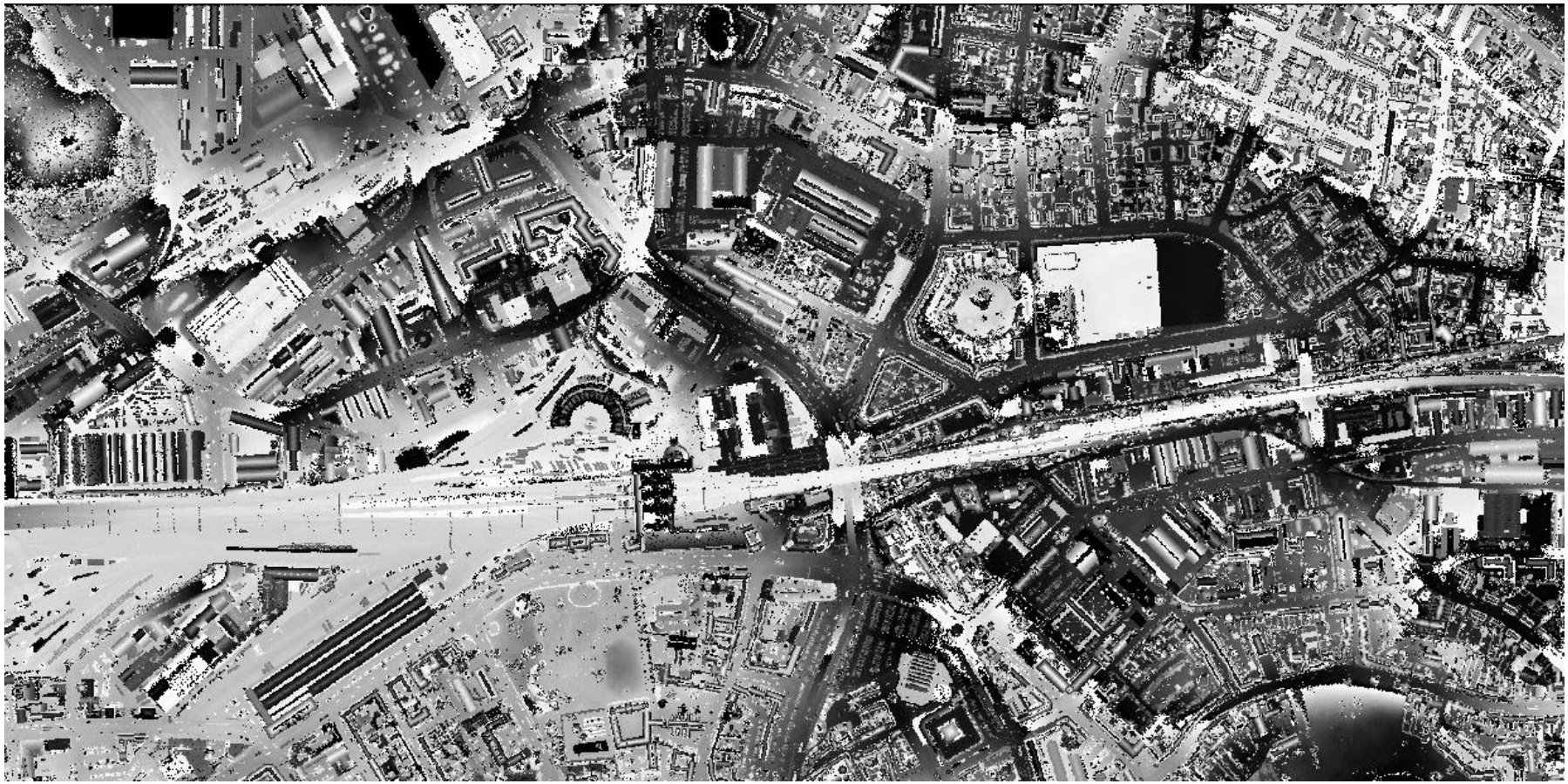
Ex.1 – Danish Rail

444.000 points



Ex.2 – Odense City area

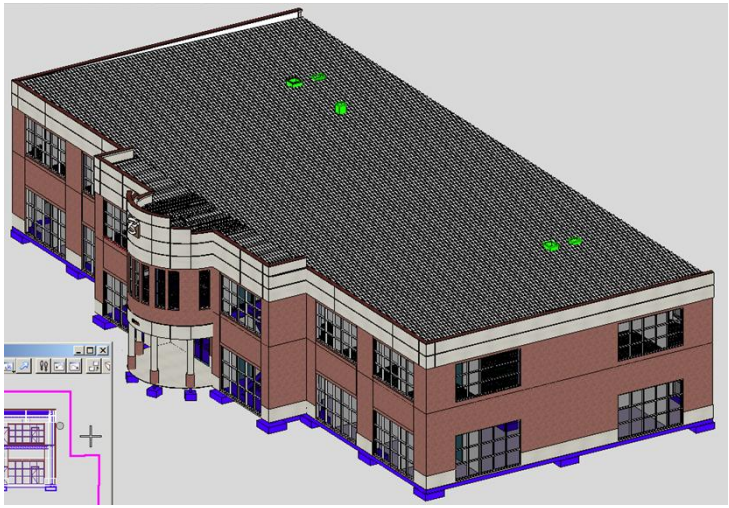
3.000.000 points



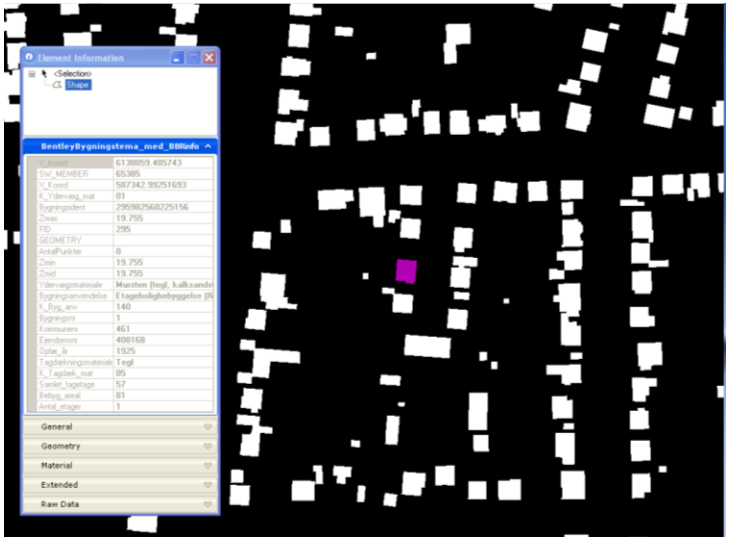
3D City & Urban Modeling – Bentleys approach

The 2D and 3D world

- 3D CAD/BIM
  - File based; engineering projects
  - High level of object details; e.g. buildings, bridges, roads…
  - Minor geographic area



- 2D and 2½D GIS
  - Databases; high level of semantic information due to DB register connections
  - Lower level of object details
  - Large geographic area; covering a metropolis, region, nation…



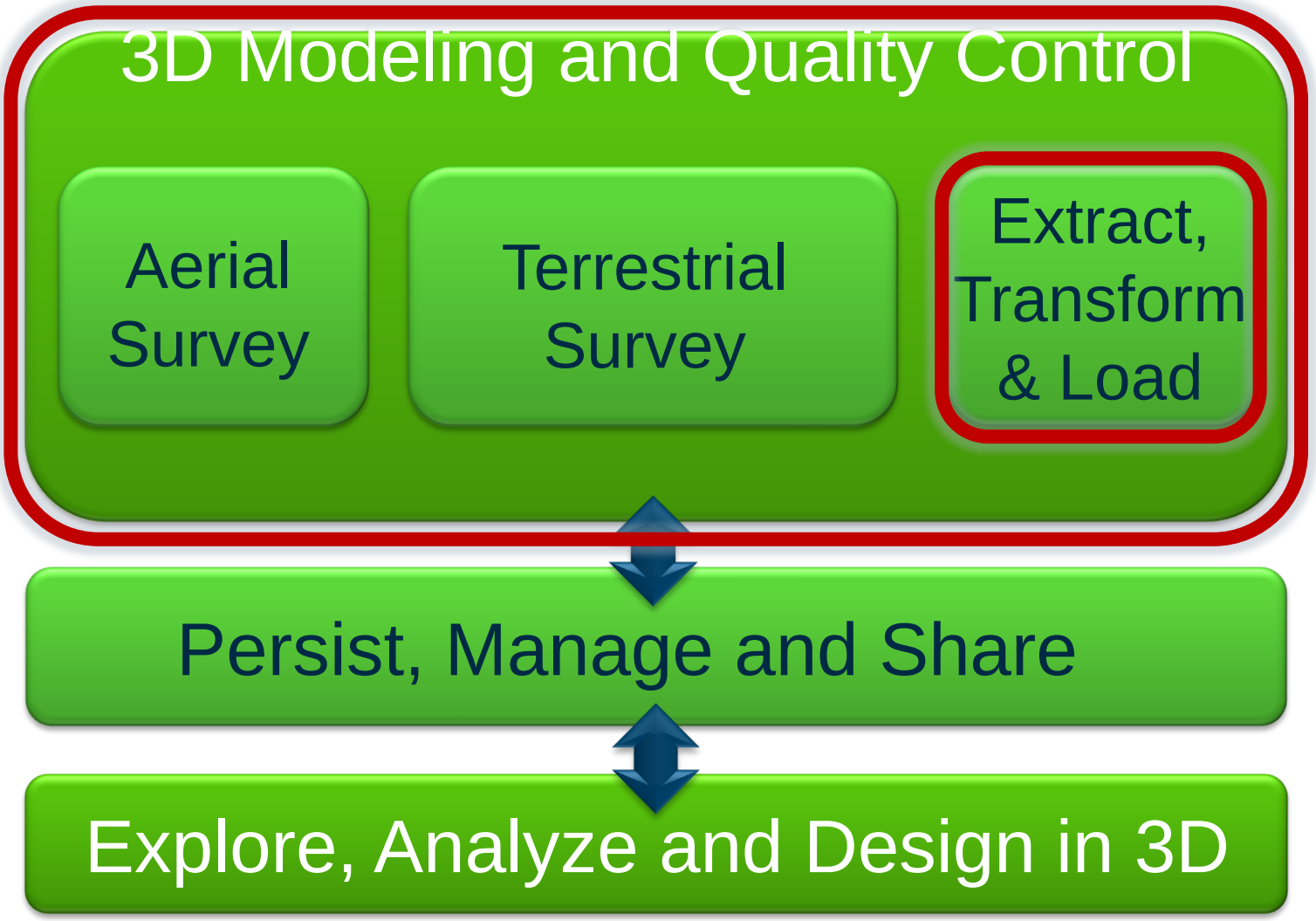
The best from both worlds - 3D City/Urban GIS

A collection of functionality and information that allows the management of a city's infrastructure

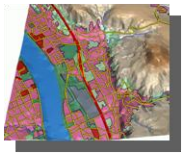
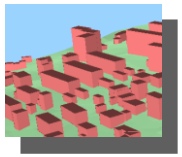
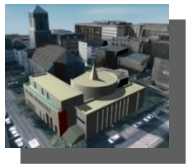
- GIS/CAD/BIM integration
- From the overview of the 3D urban assets to detailed infrastructure – from campus to large metropolis
- Intelligent objects from overview urban city objects to detailed engineering
- For seamless modeling, analysis, visualization and distribution to all stakeholders

Bentleys approach is **3D City & Urban GIS**

The 3D City GIS components



Traditional 3D modeling techniques

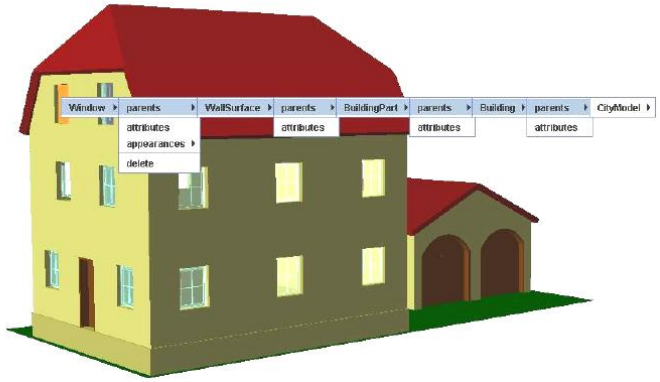
	Aerial		Terrestrial			ETL
	Photogrammetry	LiDAR	Mobile LiDAR & Photogrammetry	Static LiDAR & Photogrammetry	Land Surveying	
0-DTM 	Manual or Auto (breaklines)	Auto (discriminate vegetation)				Import (Std format)
1- Blocks 	Manual or Auto (Footprint + height)	Auto + Manual for complex cases				Auto (Footprint + height)
2-Textures, roof 	Manual and some Auto (roof lines, textures/oblique)	Auto but more manual edition	Auto (Textures)		Manual (Large scale DTM, façade)	Auto (Import CAD/BIM)
3- Detailed 	Manual (Chimneys, dormers)	Auto (Large scale DSM)	Auto (Façade)	Manual (Façade, city furniture)	Manual (façade, city furniture)	Auto (Import CAD/BIM)
4-Interior 				Manual (Inner structures)	Manual (Inner structures)	Auto (Import CAD/BIM)

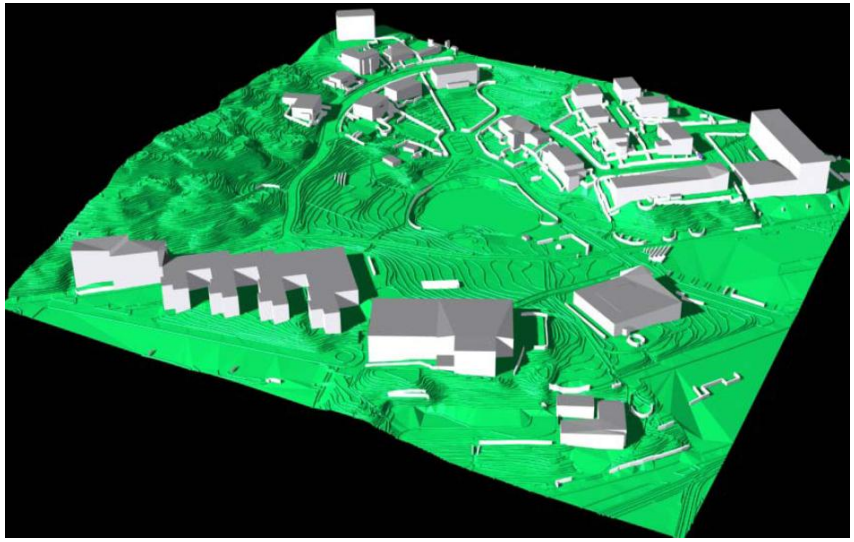
What types of features are of special interest

… for a 3D Urban Map:

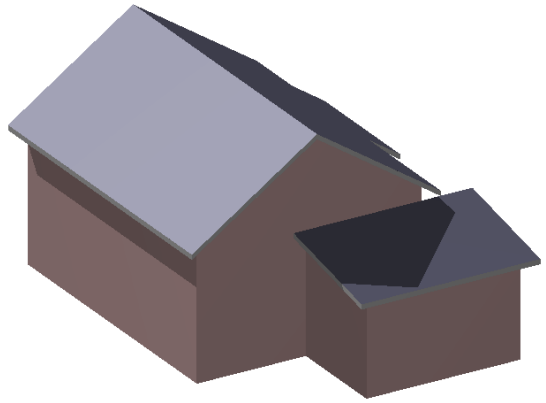
- Digital Terrain Model (DTM)
- Building objects
- Vegetation
- City and Urban “furniture's”
  - Signs, lamp posts, fences etc.
- Infrastructure objects
  - Bridges, tunnels, roads and related assets etc.
- …

3D (building) modeling – several methods





- Photogrammetry
- Aerial LiDAR
- Terrestrial LiDAR
- Conceptual
- Parametric – rule based



Bentley

Parametric 3D Urban Map modeling

- What is that?
  - Modeling of 3D objects by use of 2/2½D Base Map and related attributes; geometry and metadata
  - Definition of the rule sets decide the modeling process, variety, complexity and design of the city map
  - What do you gain: A simplified 3D City/Urban model
- What Bentley technology are used?
  - MicroStation V8i
  - Generative Components V8i
- What data are needed?
  - Building footprint
  - Data model, geo-coded metadata…

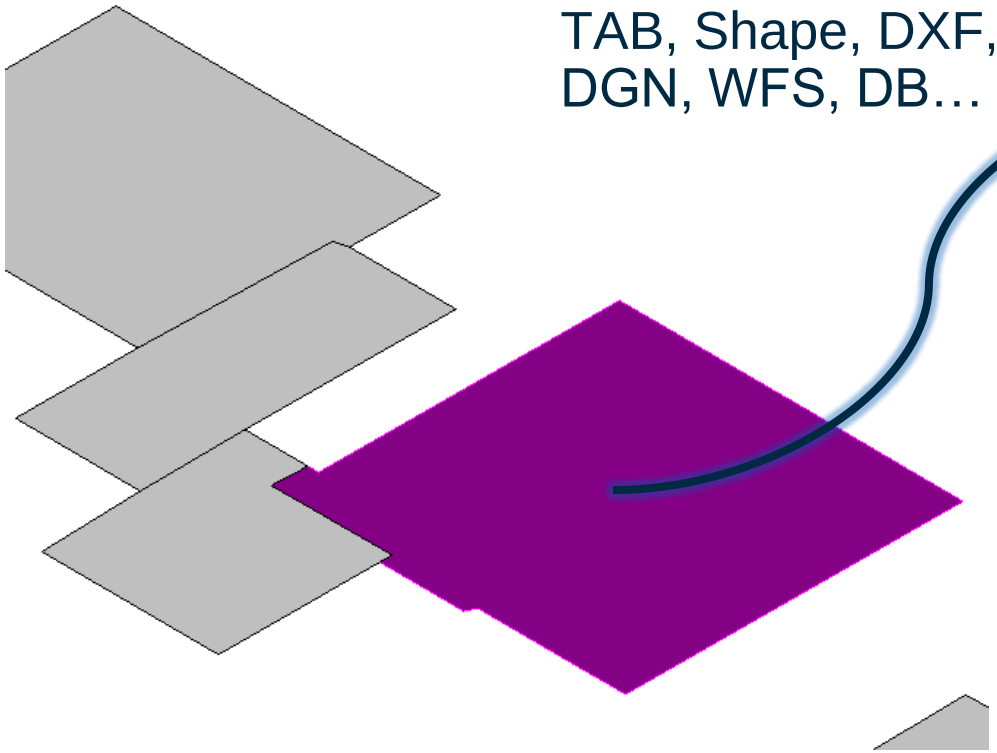
CAD & GIS Data

Building metadata

Building footprint

Data sources:

TAB, Shape, DXF, DWG, DGN, WFS, DB…



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FID	79
GEOMETRY	
AntalPunkter	0
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Bygningsanvendelse	Fritliggende enfamilieshu
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Kommunenr	461
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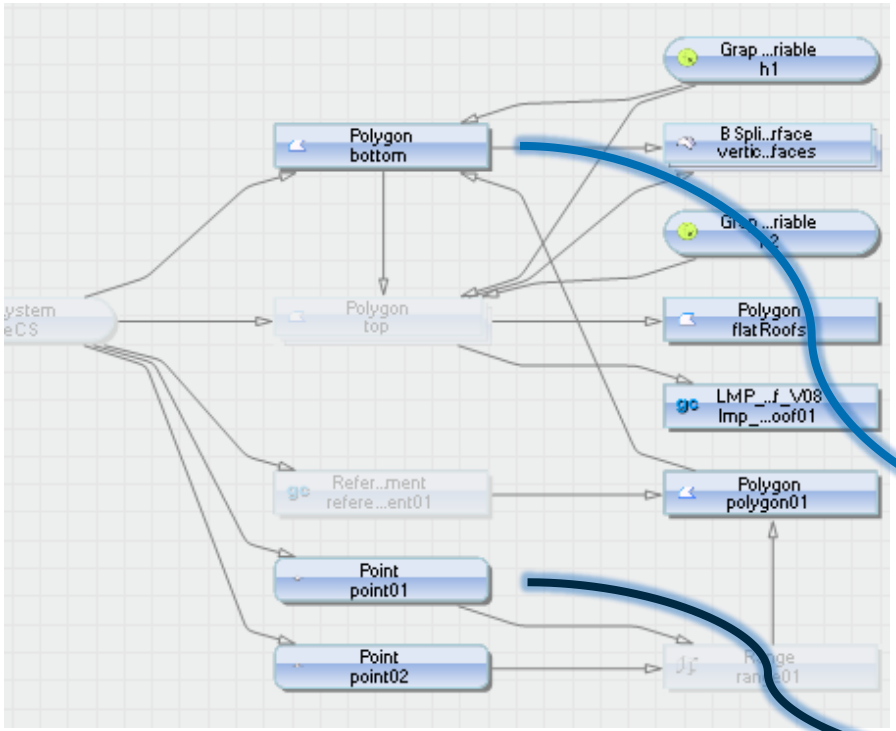
Antal_etager	1

Parametric rule set definition

Object relations based on 1) generic rule sets, 2) the FOT data model and 3) public registers, e.g. BBR



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Ydervægsmateriale	Mursten (tegl, kalksands
Bygningsanvendelse	Fritliggende enfamilieshu
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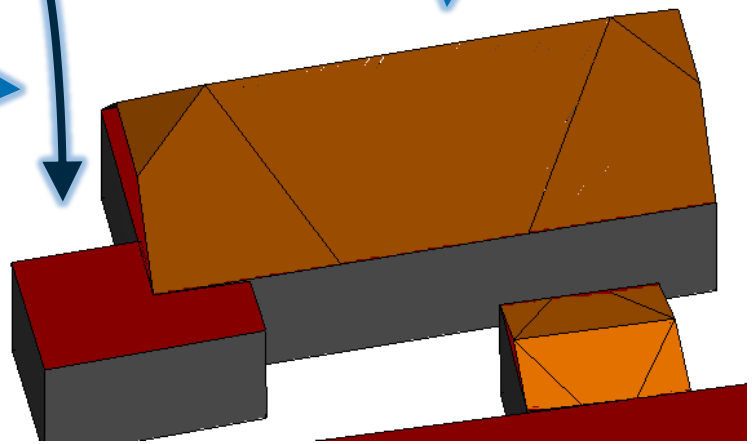


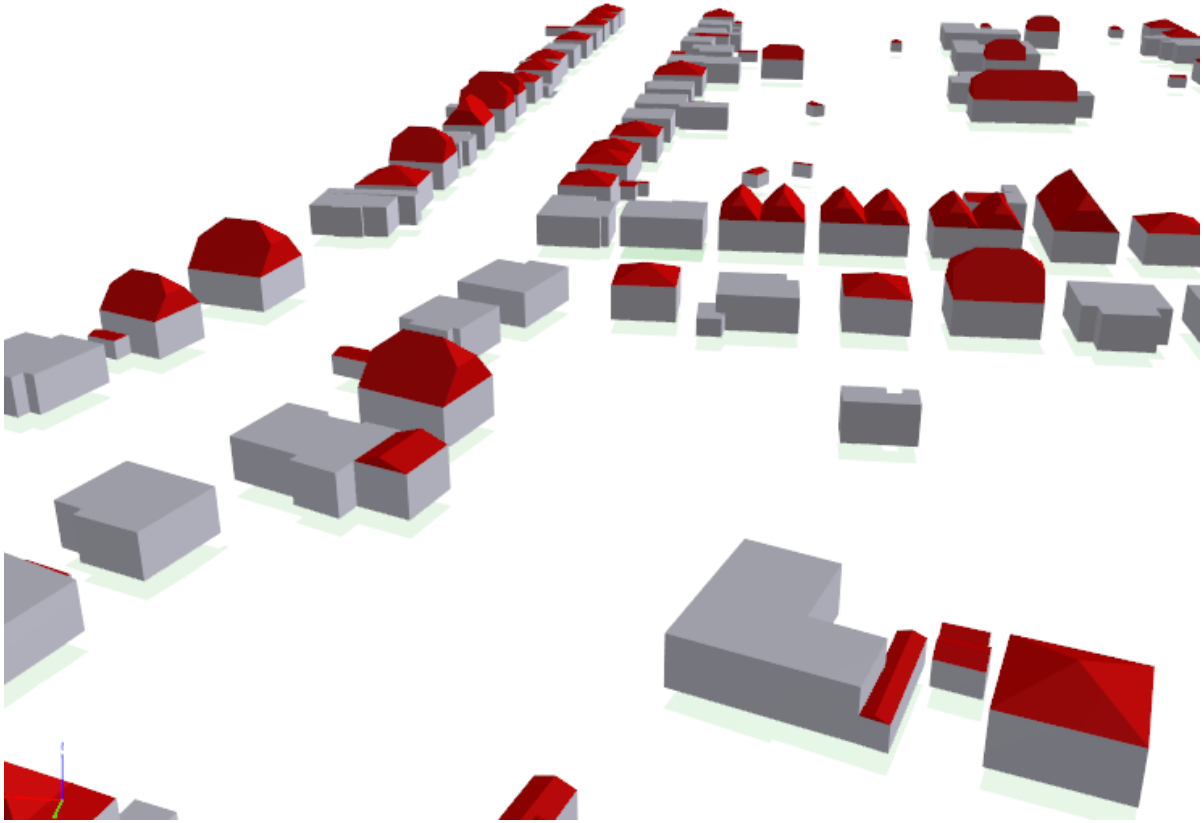
FOT data model… what is that?

FOT | DANMARK
Fællesoffentligt Geografisk Administrationsgrundlag

- To promote continuity between the geographic databases throughout Denmark, an initiative to standardise geodata across the country has been launched.
- Will improve the efficiency of geodata sharing and public administration in general
- FOT – Fælles Objekt Typer – Common Object Types

Parametric 3D City Map modeling – Pilot project

- This is the first prototype result
- Data ©City of Odense
- Live example



Derived products

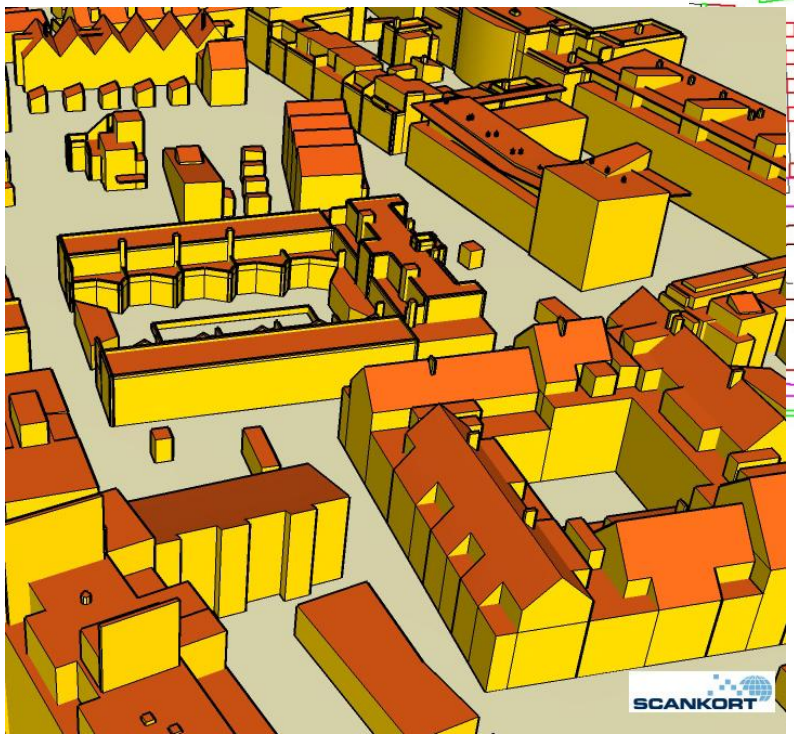
- 3D City Maps – many variations, since it depends on the pre-defined rule sets and the semantic level of detail.
- Overlay Maps, actuality and quality control
- Cluster Maps as input to 3. party solution, e.g. Telecom
- Radio & mobile unit signal propagation maps (as input to 3. party, Telecom, Railway service operators etc.)
- Noise propagation maps (as input to 3. party, e.g. SoundPLAN)
- …

The SWOT analyse

- Strengths
  - Easy to perform the modeling task – “one bottom click”
  - No specialized skills needed for the end-user
  - A semantic very rich model – inherit semantic data from original GIS Systems, DB’s…
  - Not only building objects – all FOT features can be generated and visualized
  - Dynamic model – can be updated on-the-fly from the 2D Base Map, attribute schemas…
  - Very fast “processing” – few minutes
- Weaknesses
  - A very new concept
  - Will not represent the reality 100% - based on assumptions
  - The data quality will have a direct impact of the modeling result

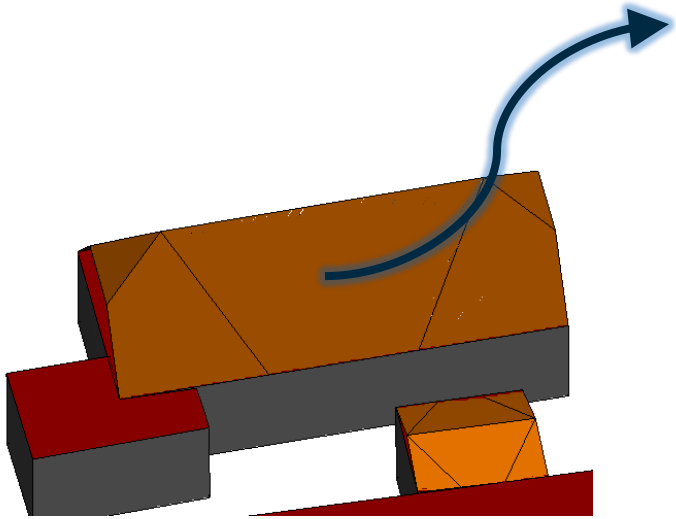
Object refinement

- Level of detail

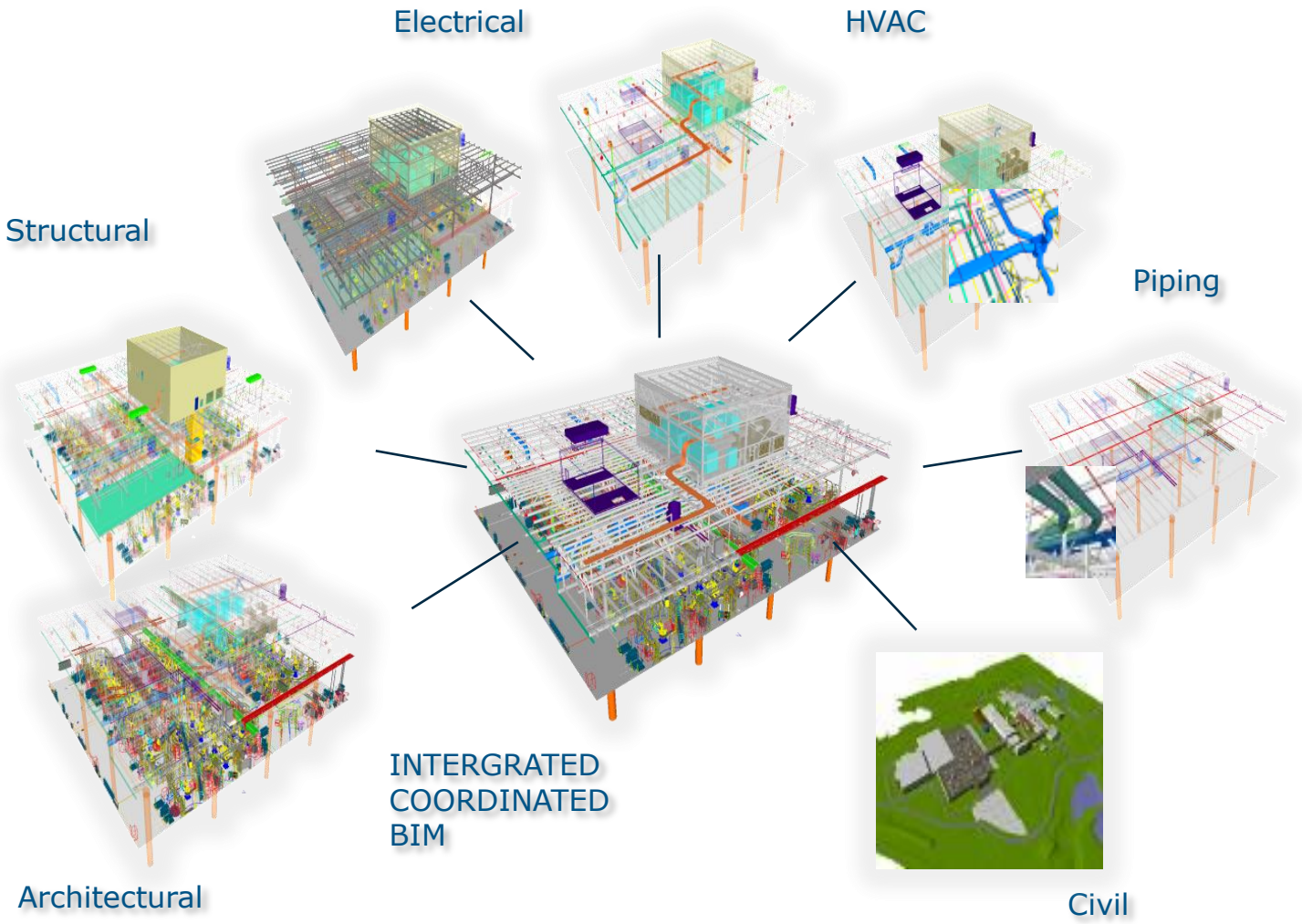


Object refinement

- Which technologies are available?
  - Predefined templates in GC for further enhancements
  - MicroStation conceptual 3D modeling tools
  - Photogrammetric workstations
  - Classified and filtered LiDAR data
  - Data Warehouses, e.g. 3D Google Warehouse
  - Materials
  - Textures



Building Information Model (BIM) integration



3D Modeling with Bentley – Sum-up

- Based on the same platform -> MicroStation
- Bentley users can go…:
  - From Images to 3D Objects
  - From Point Cloud to 3D Objects
  - From Data Models to 3D Objects
  - From Land Surveying Measurement to 3D Objects
  - From disparate available data to 3D Objects

-> Seamless workflow

-> Quality Control


Thank you