Reality Modeling Goes Mainstream:
What's New in ContextCapture

November 2017

Jerard Marsh

Introduction

Quick poll

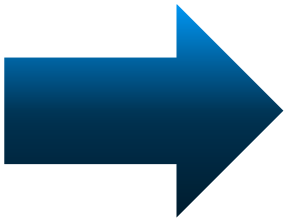
- ContextCapture users ?
- Other Bentley reality modeling product users ?
- Total beginners ?
- Persons in charge of data capture ?
- Persons consuming reality modeling data ?

What is reality modeling ?

Capturing existing conditions in **3D using one or a combination devices.** (UAVs, Handheld Camera, Laser Scanner)

to support different applications such as

Mapping, Design, Construction, Inspection and **Asset Management**



Bentley

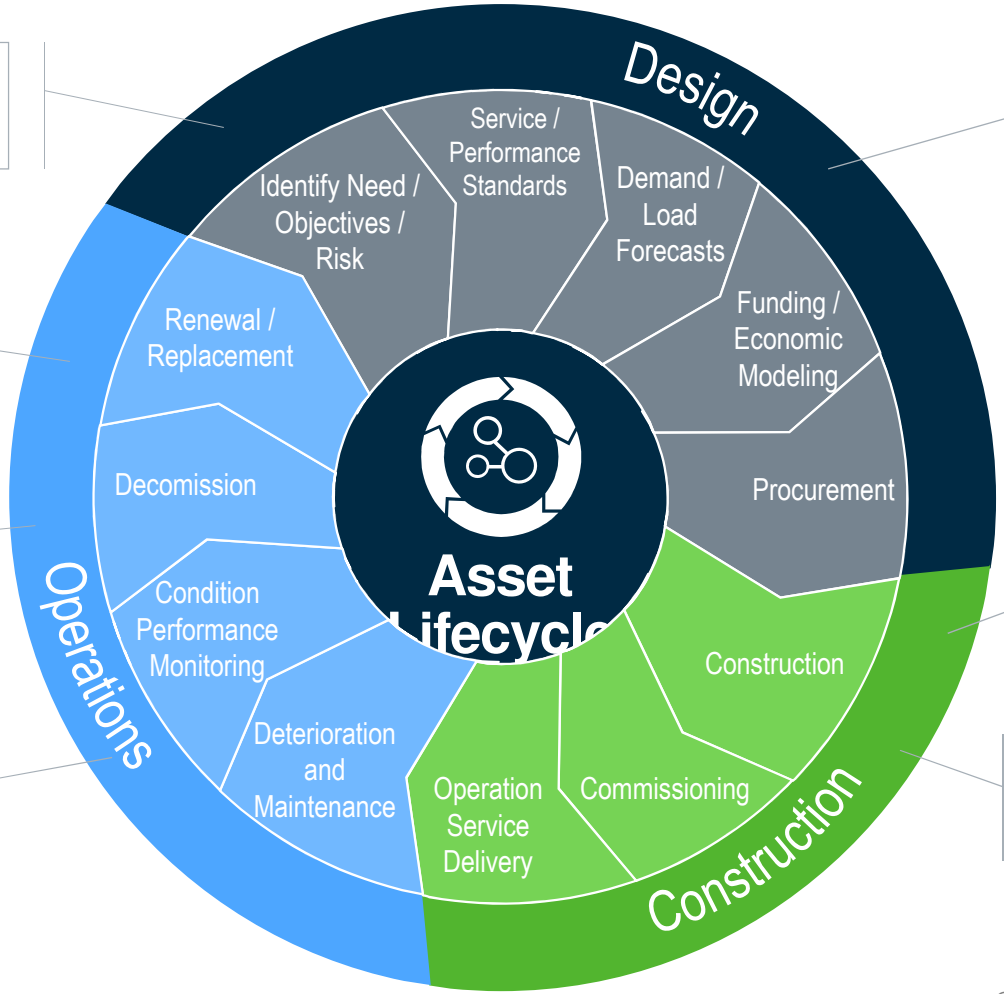
Why Model Reality?

Understand the existing conditions

Virtual Inspection

Visual Operation

Training and simulation



Risk management

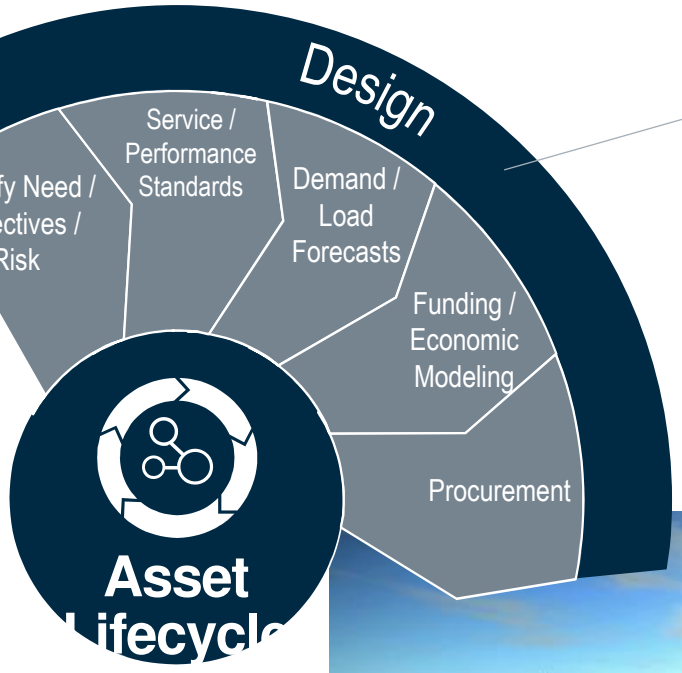
Changes detection

Document construction

Bentley

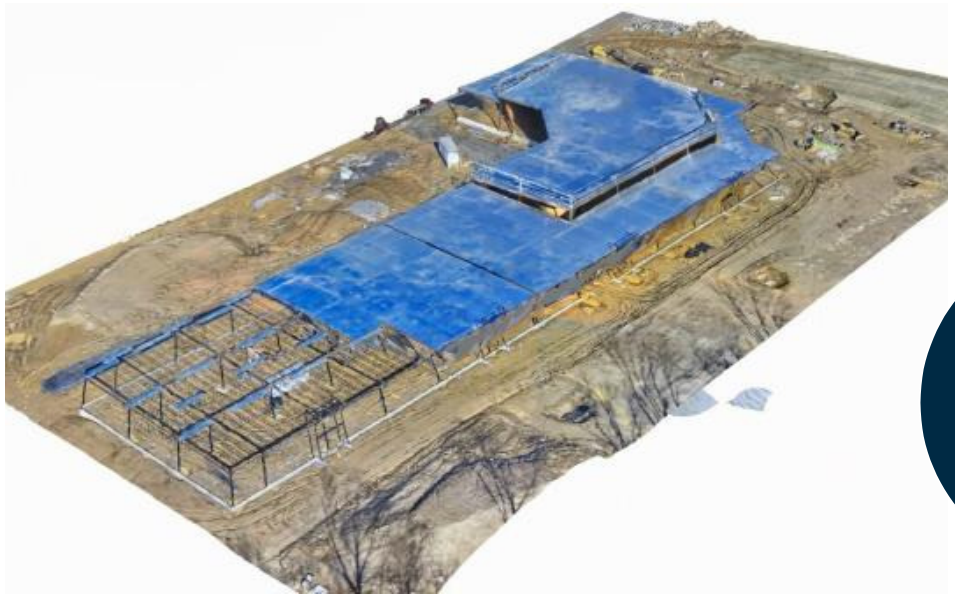
Why Model Reality?

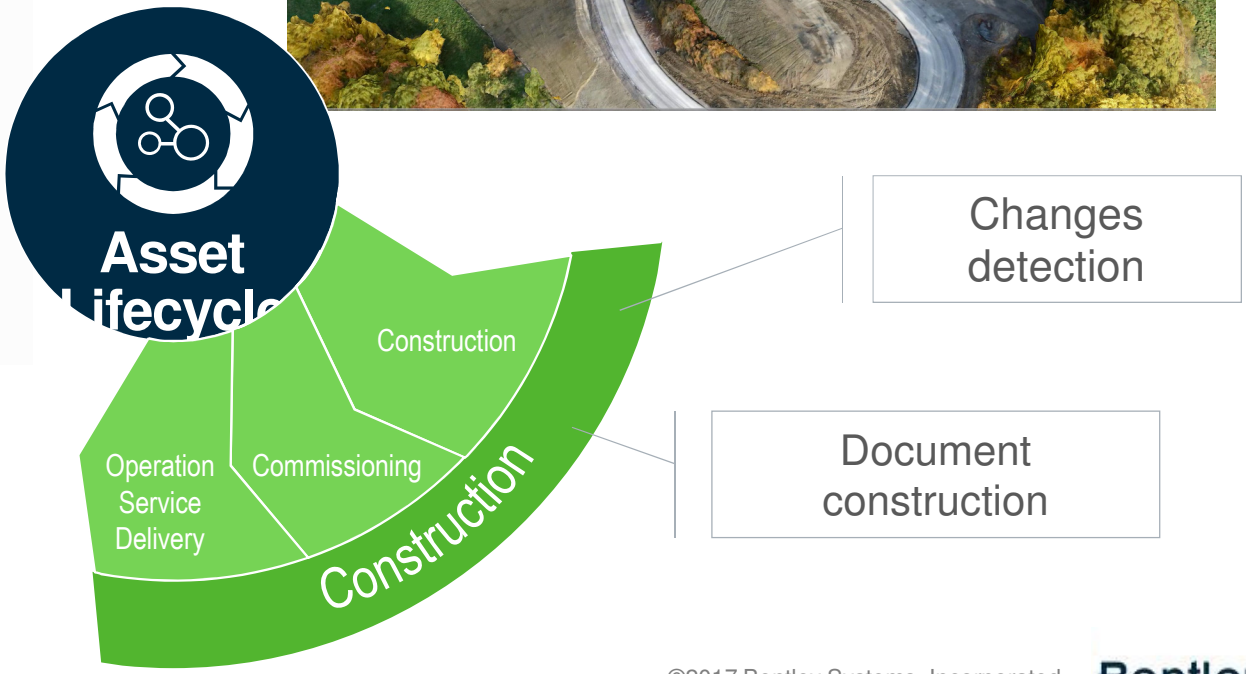
Understand the existing conditions



Risk management

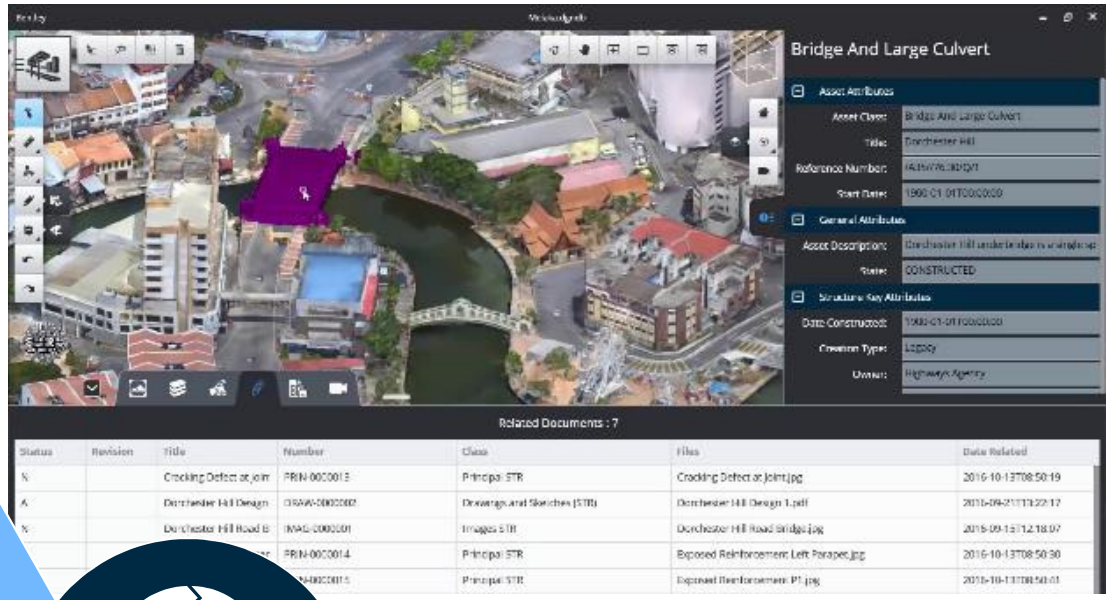
Why Model Reality?





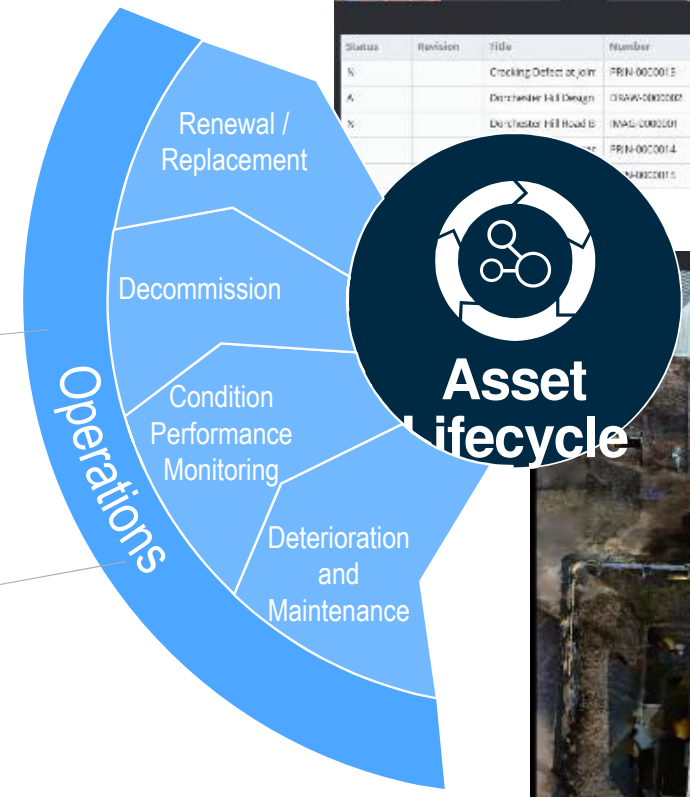
Bentley

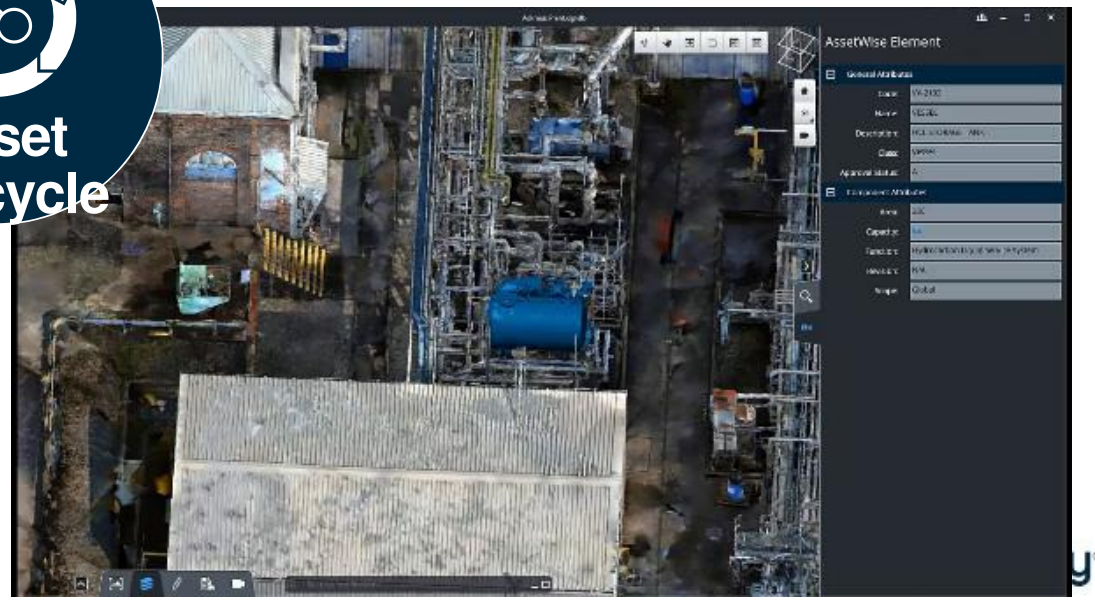
Why Model Reality?



Visual Operation

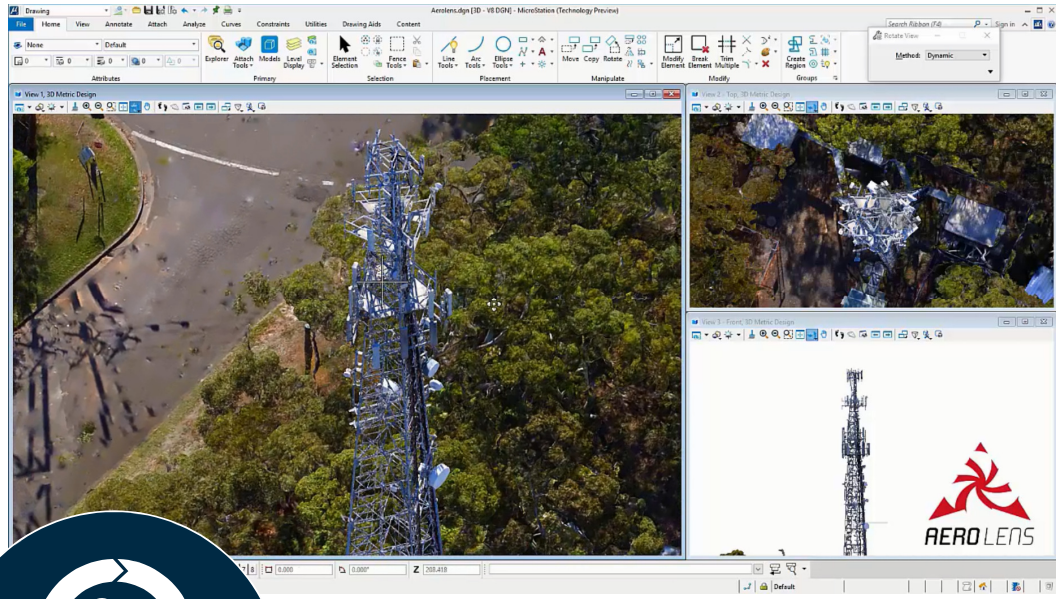
Training and simulation





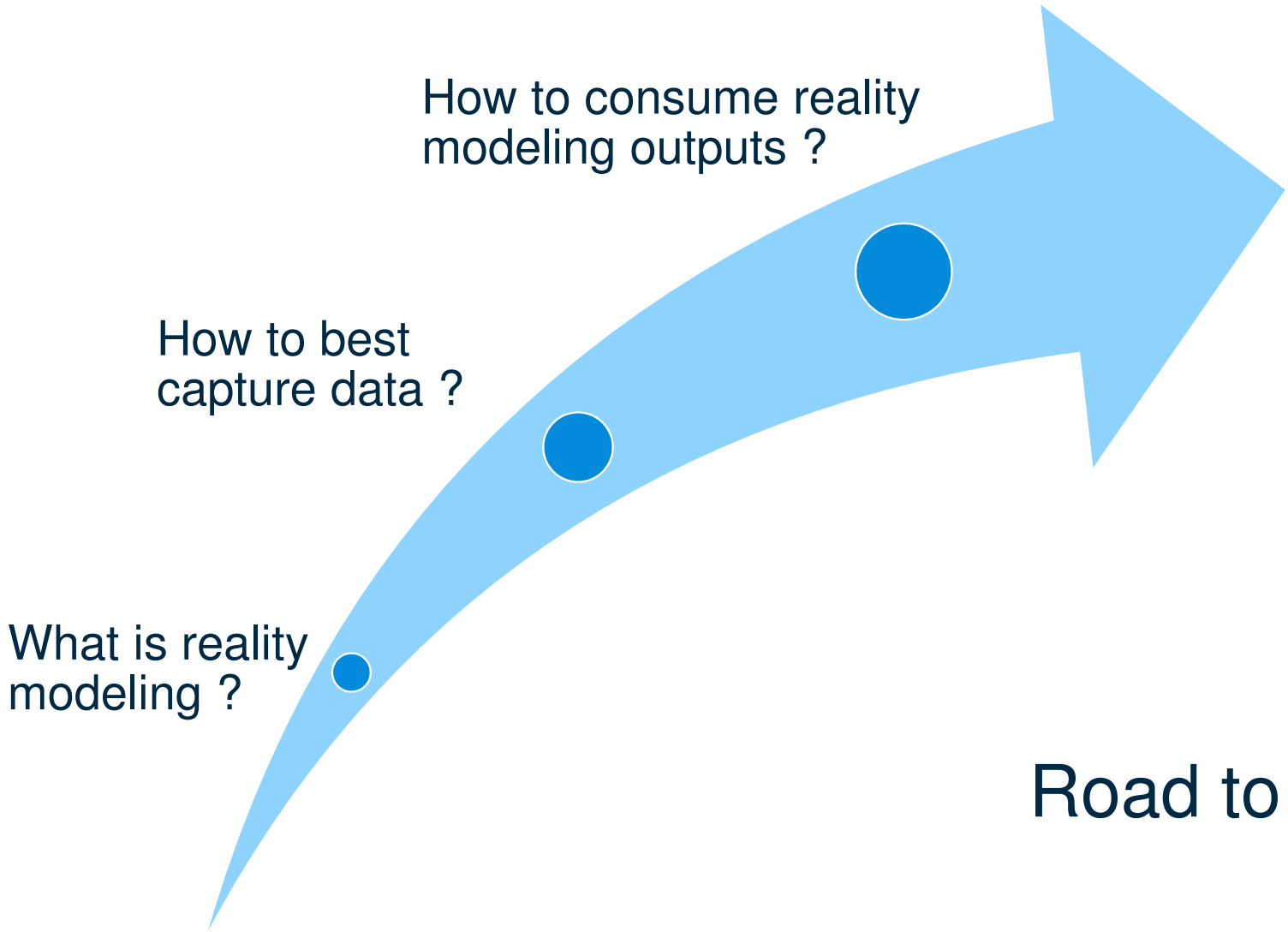
Why Model Reality?

Virtual Inspection



The Reality Modeling Academy



Road to success

Bentley

What is reality modeling ?

- Increasing Awareness and adoption of reality modeling
- Reality modeling academy to help spreading the word in the industry

- Sharing users success stories
- If a user drastically improved his workflow, why can't I ?

- Thought leadership

How to capture data to get usable results ?

- What capture techniques are available ?
- What are the pros and cons ?

- Assessing the challenges
- How to choose which technique to use ?

- How do I capture data on the field ?
- Acquisition techniques and tools

How to consume reality modeling data ?

- How to handle/store/share those new outputs ?
- Large 3D meshes made of billions of triangles

- How can reality modeling improves existing workflows ?
- Workflows specific for each industries

- How reality modeling offers innovative workflows ?

Reality Modeling Academy

The objectives of the Reality Modeling Academy are to:

- Increase awareness and adoption of reality modeling
- Offer best practices for reality modeling data capture and outputs
- Ensure easy integration of reality modeling solutions in your workflows
- Share innovative uses of reality modeling in industry workflows
- Bring an exhaustive Reality Modeling knowledge base




Bentley

How to achieve this

- The academy to deliver specific trainings per industries and asset types
- Training centers for data capture
- Partnership with drone pilot schools

Partners network

- Qualified partner to deliver RMA trainings

- Qualified partner to deliver services using Bentley reality modeling products
- Benefit top tier support / potential connection with Bentley network

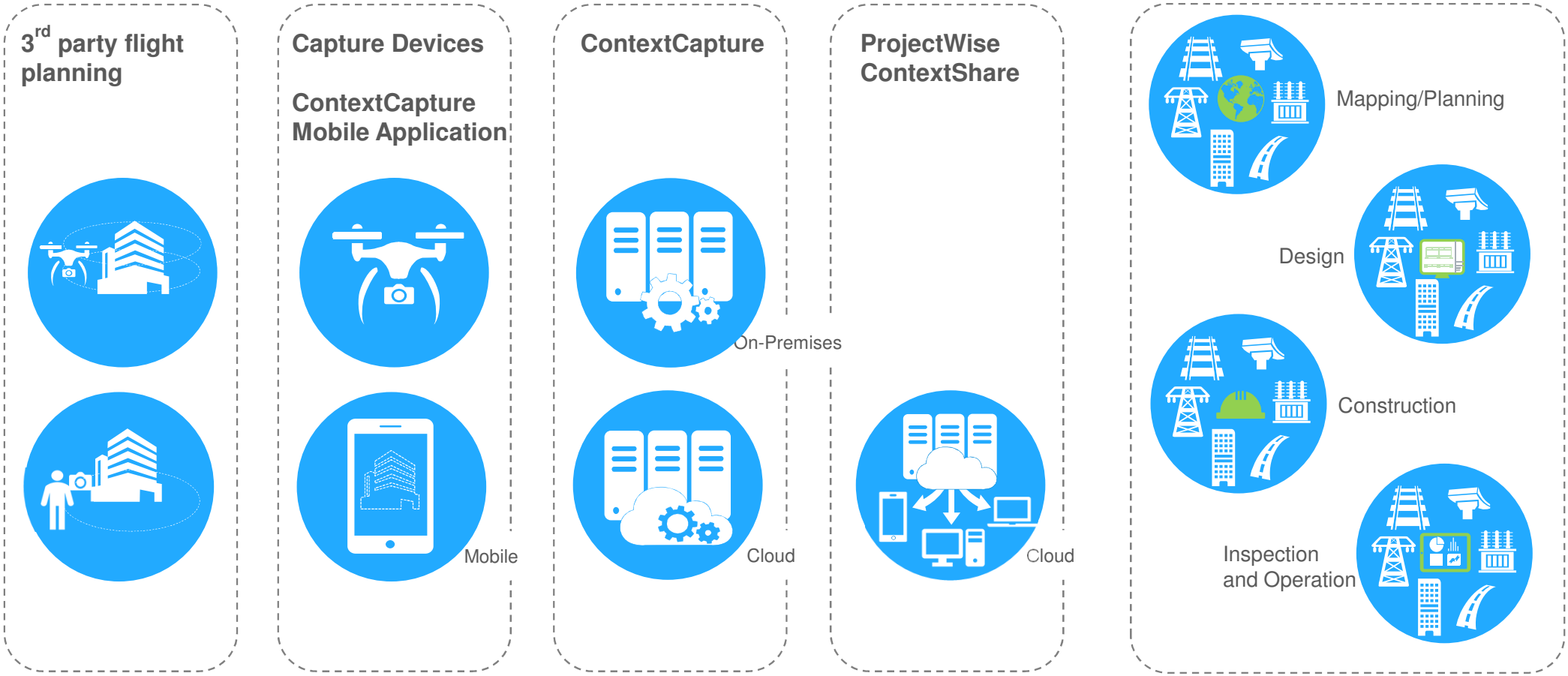
- Enterprises, software companies, and researchers taking advantage of Bentley's RM technology to deliver innovative solutions and services
- Benefit top tier support / potential connection with Bentley network

Bentley

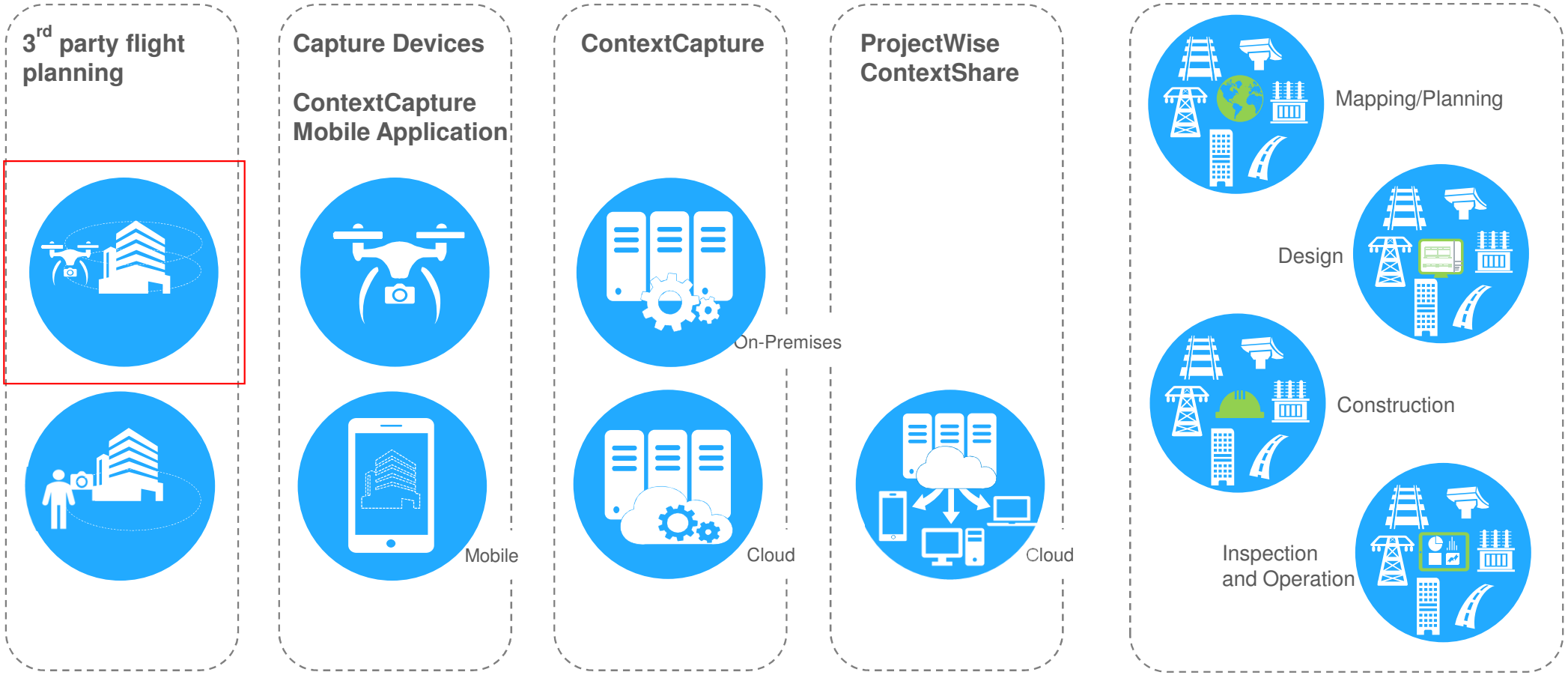
What's new?




Bentley
Advancing Infrastructure



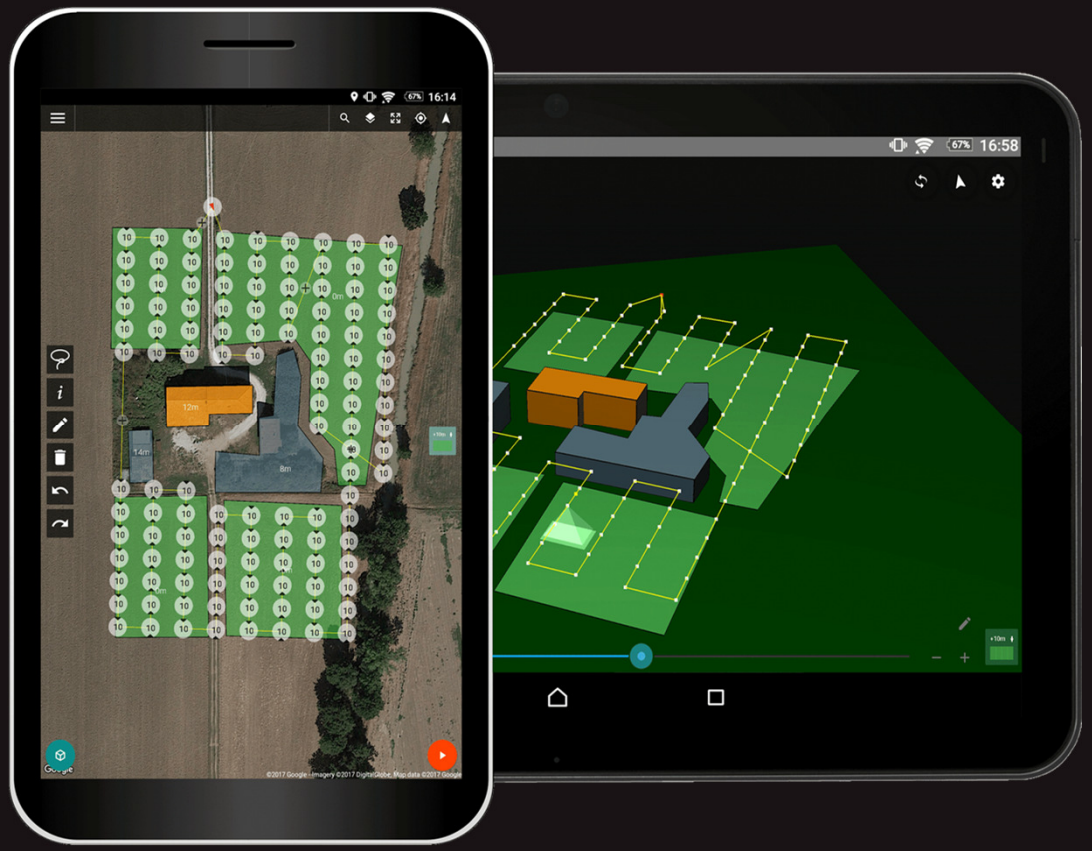
Bentley



Bentley

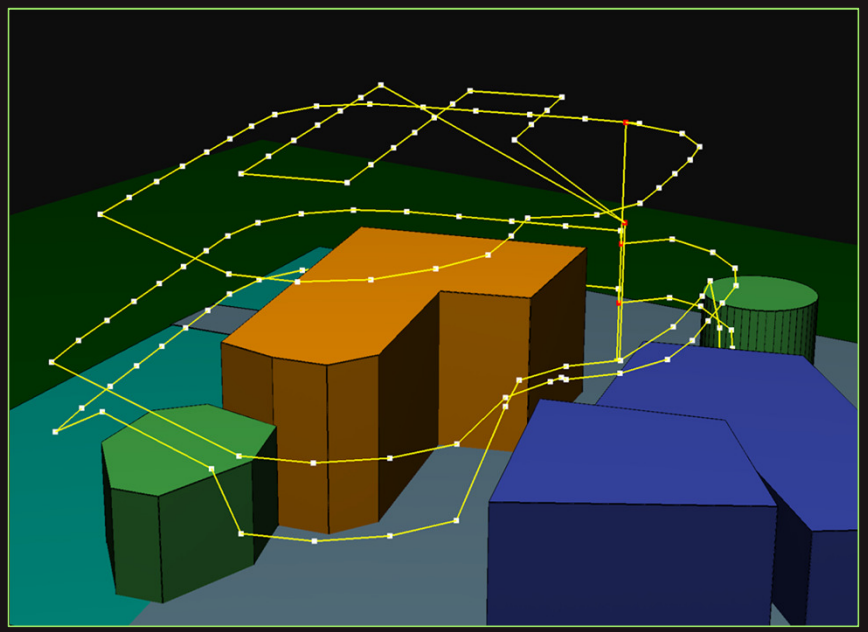
DRONE HARMONY

Professional Flight Planning App



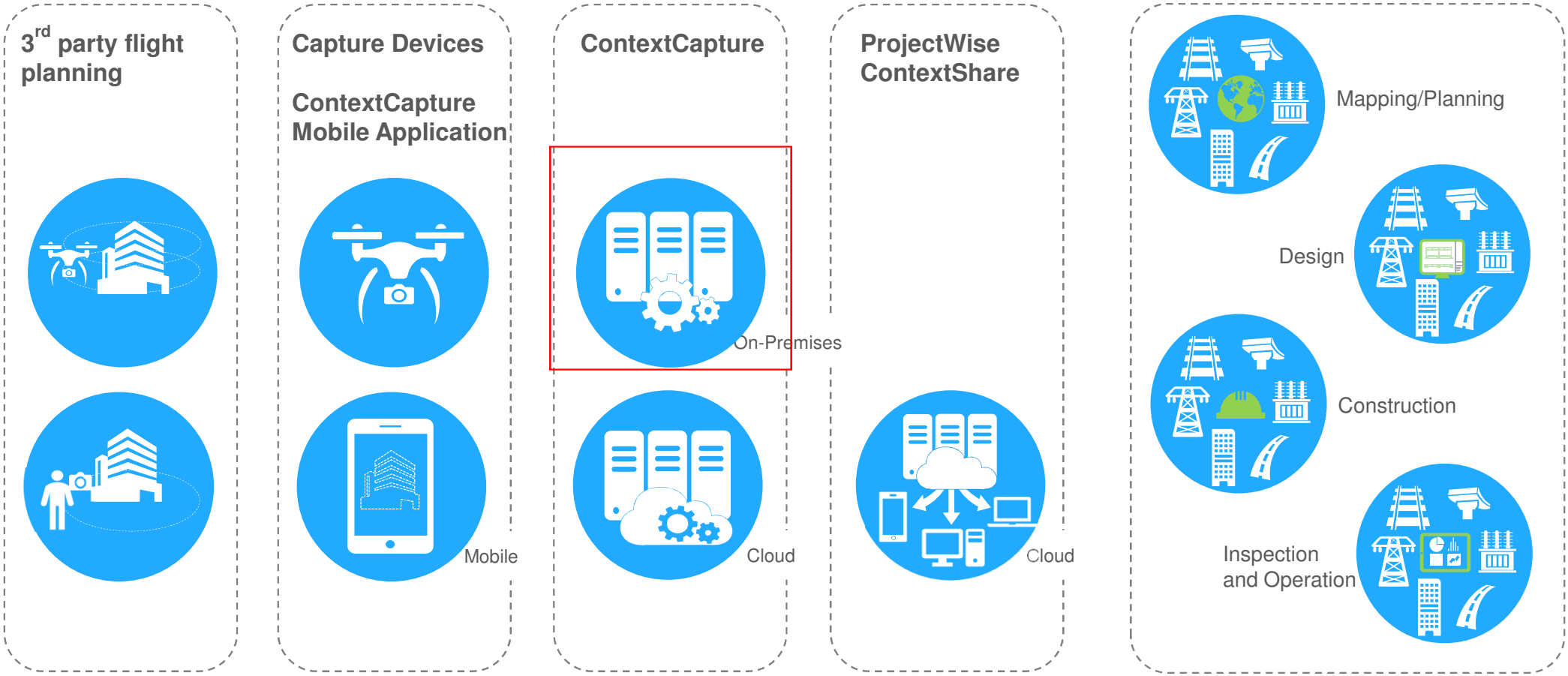
A TURNKEY SOLUTION FOR YOUR COMPLEX MISSION PLANNING TASK

- ➔ Full 3D work environment
- ➔ Automatic obstacle avoidance
- ➔ For complex industrial scenarios
- ➔ Tailored smart missions
- ➔ Easy handling
- ➔ For industry professionals



DRONEHARMONY.COM

Mission Planning for Industry Professionals



Bentley

ContextCapture – Update 5, 6 improvements

- Getting faster and better
  - Increased robustness of aerotriangulation and Reconstruction
  - Parallelizable aerotriangulation
  - Support Multi-GPU on the same machine
  - Unique Mesh export for faster handling of city or country wide scenes
  - New Global Color Equalization algorithm
    - new paradigm enriching drastically the visual quality of generated models

ContextCapture – Update 5, 6 improvements

- New inputs and outputs
  - Export to new Scalable Mesh (*.3SM, or Web ready 3D Tiles)
  - Leveraging registered laser scans from fixed and mobile scanning systems
  - Thermal camera (far infrared) support
  - Resolution Maps (shows average resolution of each point of the 3D model)
  - Native support of DGN for production and retouch workflows
  - Rig support (multi-camera systems)

What is 3SM? The secret sauce

- Mixed 2.5D or 3D mesh format
- Directly created in 2.5D inside many products
  - ConceptStation, Descartes, CC Editor
- Created in 3D inside ContextCapture
- 3SM can be used directly inside many products
  - MicroStation, OpenRoads/OpenRail ConceptStation, OpenRoads/OpenRail Designer, LumenRT, etc.…

Bentley

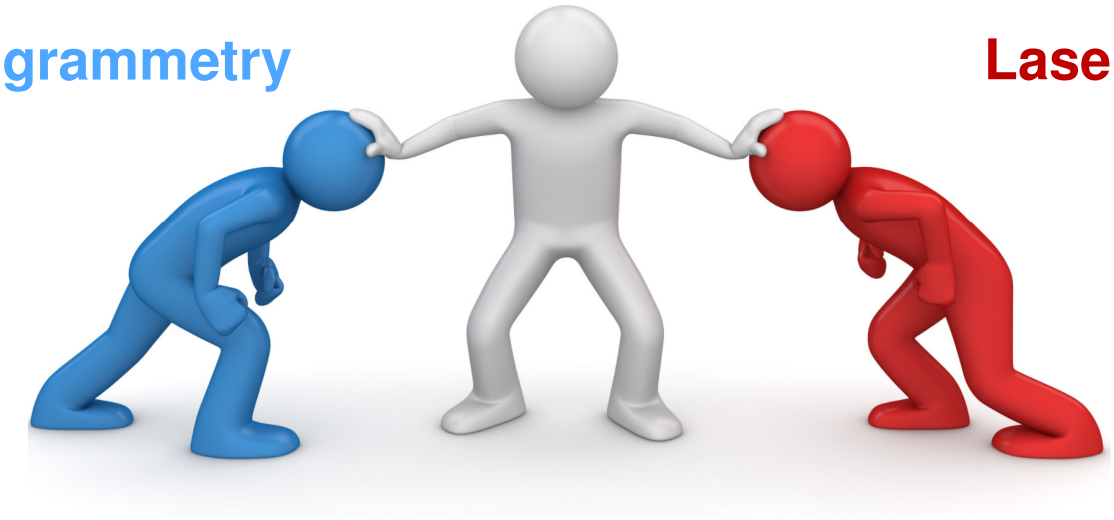
Using ContextCapture to leverage photos and lidar point cloud data




Bentley
Advancing Infrastructure

Photogrammetry

Laser scanning



Bentley

Strengths and weaknesses

Technique	Strengths	Weaknesses
Laser scanning	Certified accuracy Repeatability Uniform/glossy materials	Frequent occlusion
Photogrammetry	High-quality color information Little occlusion	Uniform/glossy materials Thin parts

Bentley

Chemical plant use case

Bentley

What capture technique should I use ?

Mission: create a reality mesh for asset visualization and management

Requirements: a 3D mesh

- Of the entire site (high, non-rechable areas)
- With Photorealistic texture (identidy labels, surface state, etc.)
- With great geometry details (numerous pipes)

Bentley

Acquisition devices

Acquisition

- "**Multi-modal**" acquisition is **required!**
- **Drone: Topcon Falcon 8** + Sony ILCE-7R (36-MP)
  - **131 photos**
  - 30 min
- **Ground:** Nikon D810 (36-MP)
  - **1697 photos**
  - 90 min
- Laser scanning: Topcon GLS-2000
  - **56M points** in **13 laser scans**
  - 150 min

Bentley

Hybrid Reality Modeling with Bentley ContextCapture

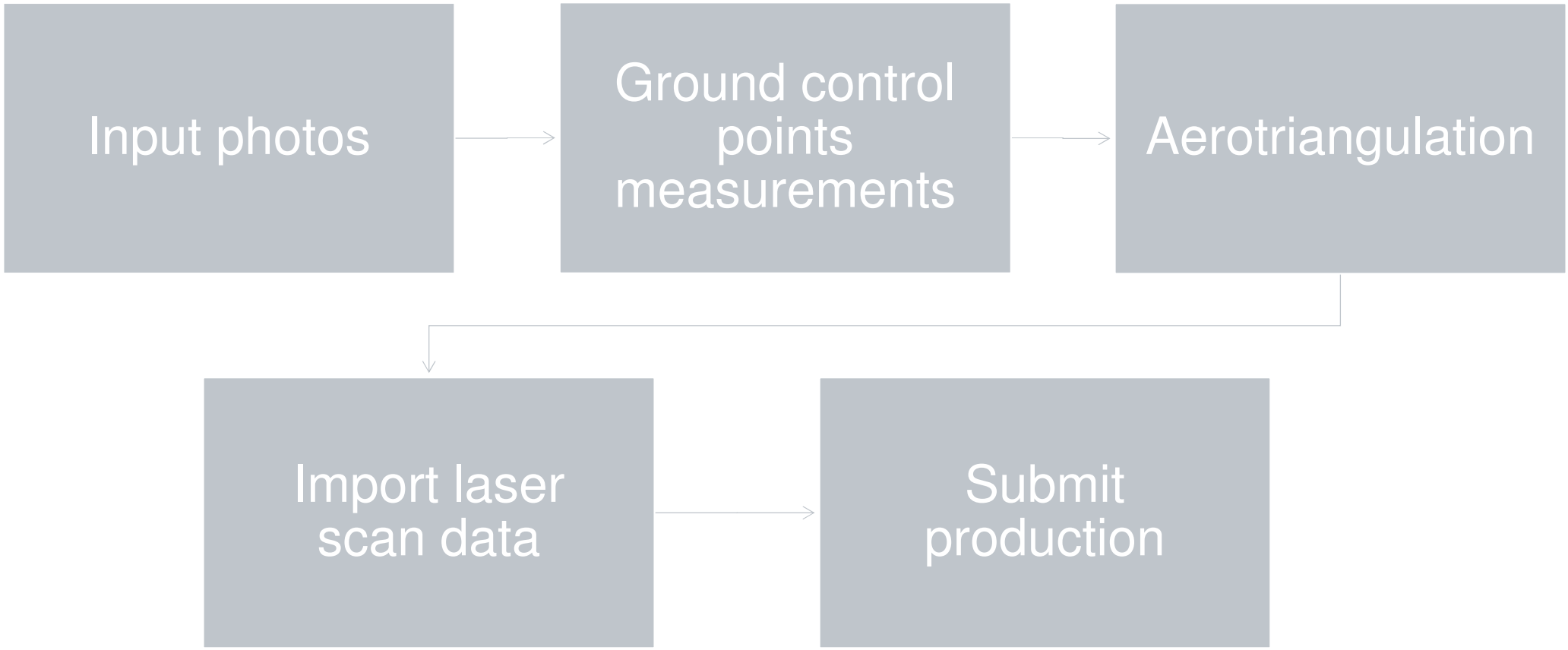
3D Reality Data Fusion is challenging!

- Multiple data sources
- Referencing of input data sources
- Large quantity of data
- Wide resolution range
- Chunks covered by photos only, lidar only or both.

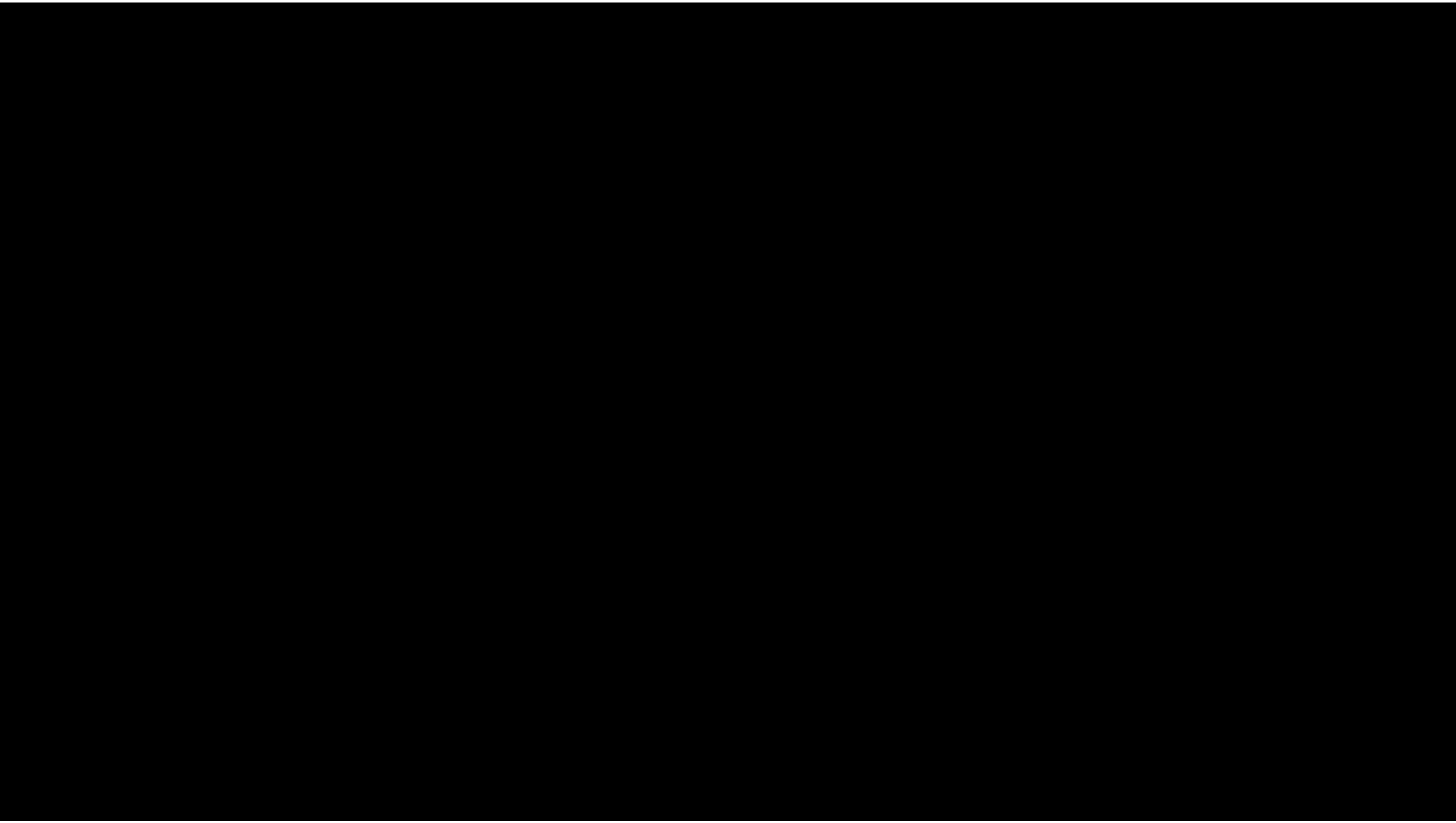
ContextCapture can generate a high-quality **3D reality mesh** from a combination of **laser scans** and **digital photographs**

Bentley

Processing in ContextCapture



Bentley



Processing in ContextCapture

Limitation: No automatic photo block to point cloud alignment

→ Photo block and point cloud must be aligned before processing the 3D model

Georeferenced point cloud and photos block using surveyed ground control points

Align the photos block using control points extracted from the laser scan data

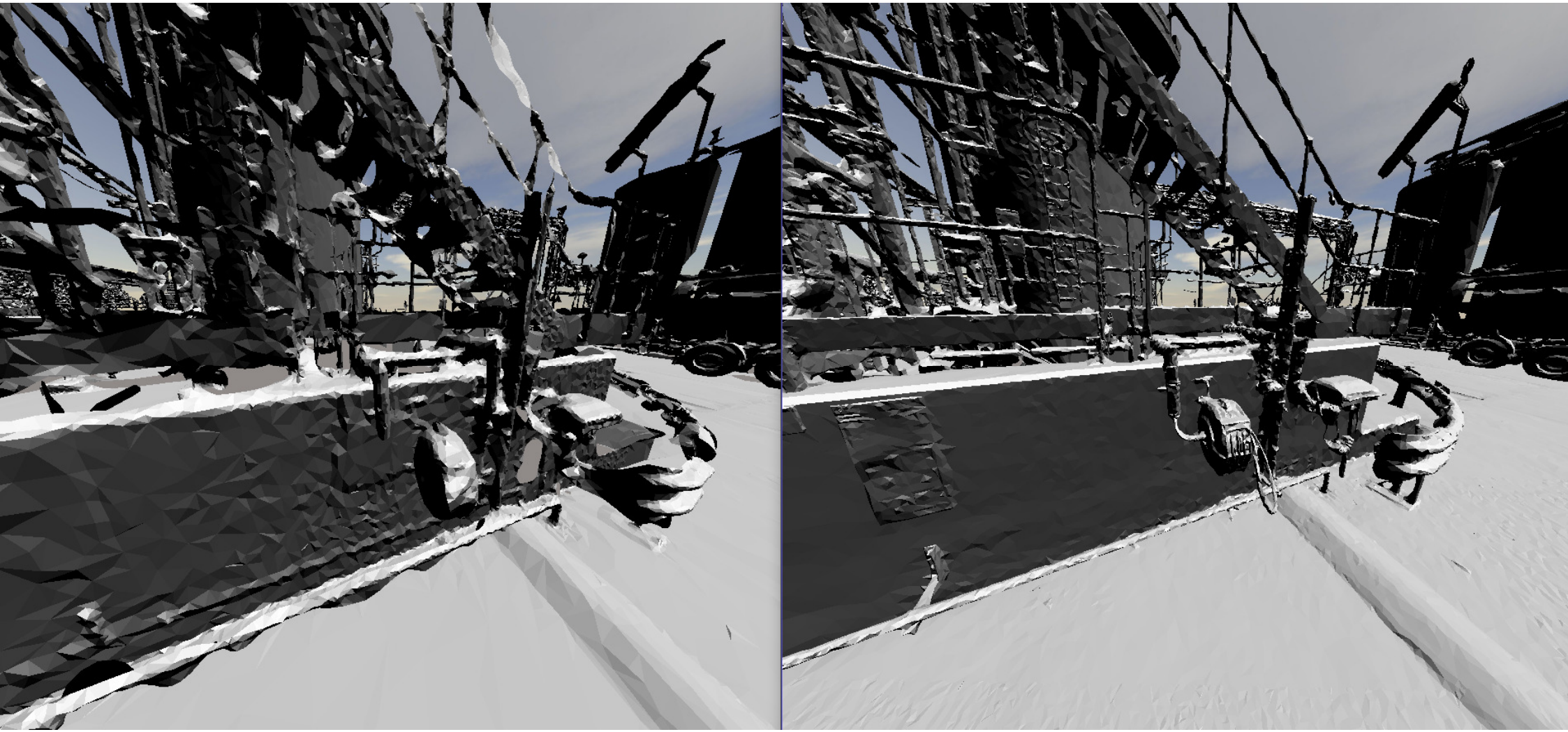
Bentley

Lidar only

Hybrid mesh

Lidar only

Hybrid mesh

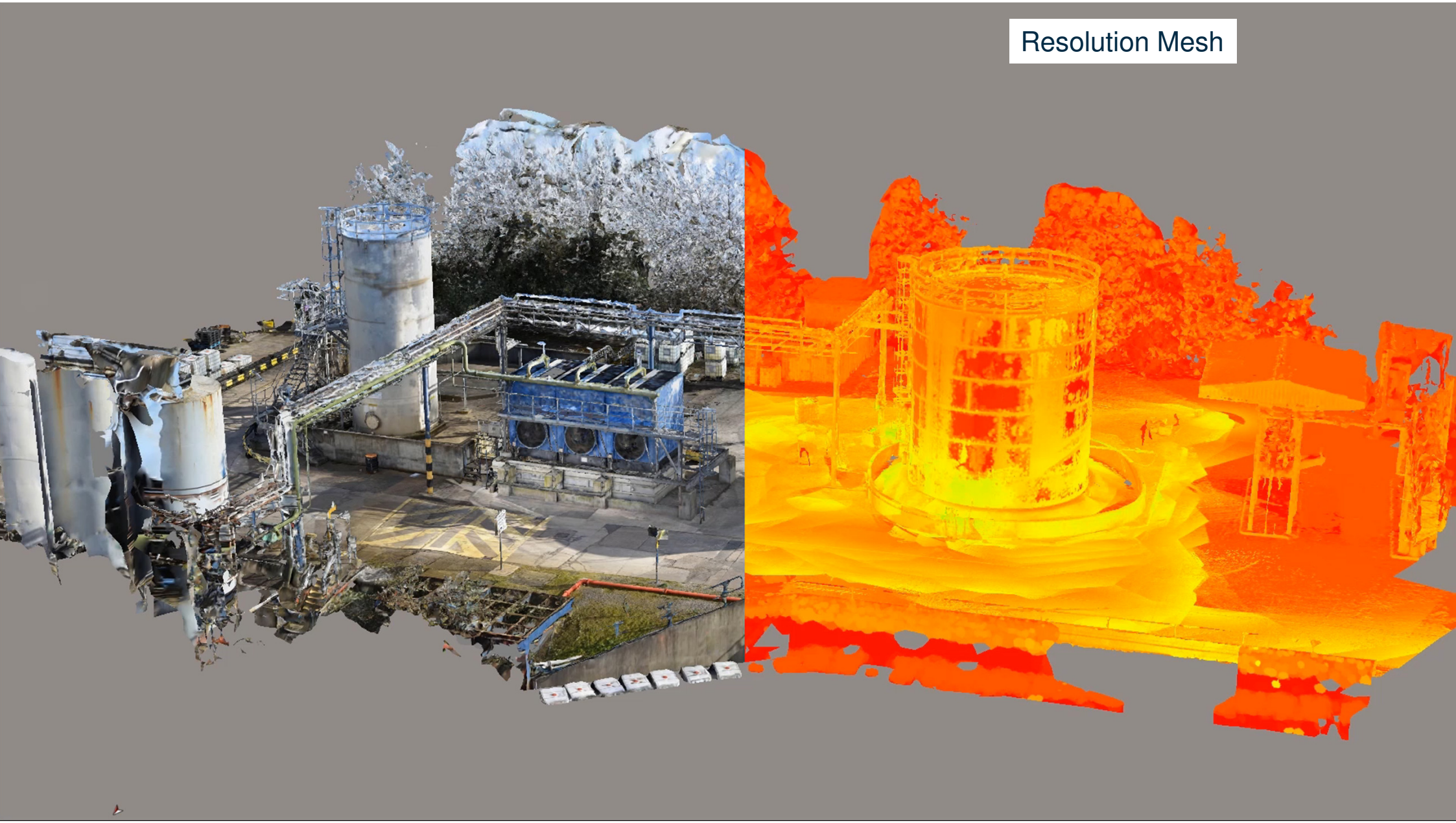


3SM – A More Complete Solution

Function	DTM, TIN	STM	3MX	3SM
Scalable - Support extremely large datasets	No	Yes	Yes	Yes
Scalable- Streamable	No	No	Yes	Yes
True 3D - Can represent objects like walls, overhangs, bridges, buildings etc.	No	No	Yes	Yes
True 3D – mixed 2.5D/3D in the same mesh	No	No	No	Yes
Engineering ready – direct targetable	Yes	No	No	Yes
Engineering ready - Calculate accurate quantities	Yes	No	No	Yes
Engineering ready- break line, holes, etc.	Yes	Yes	No	Yes
Visualization ready - Maintain full quality/resolution when going to visualization	Yes	No	No	Yes

Bentley


Thermal
ONLY ONLY

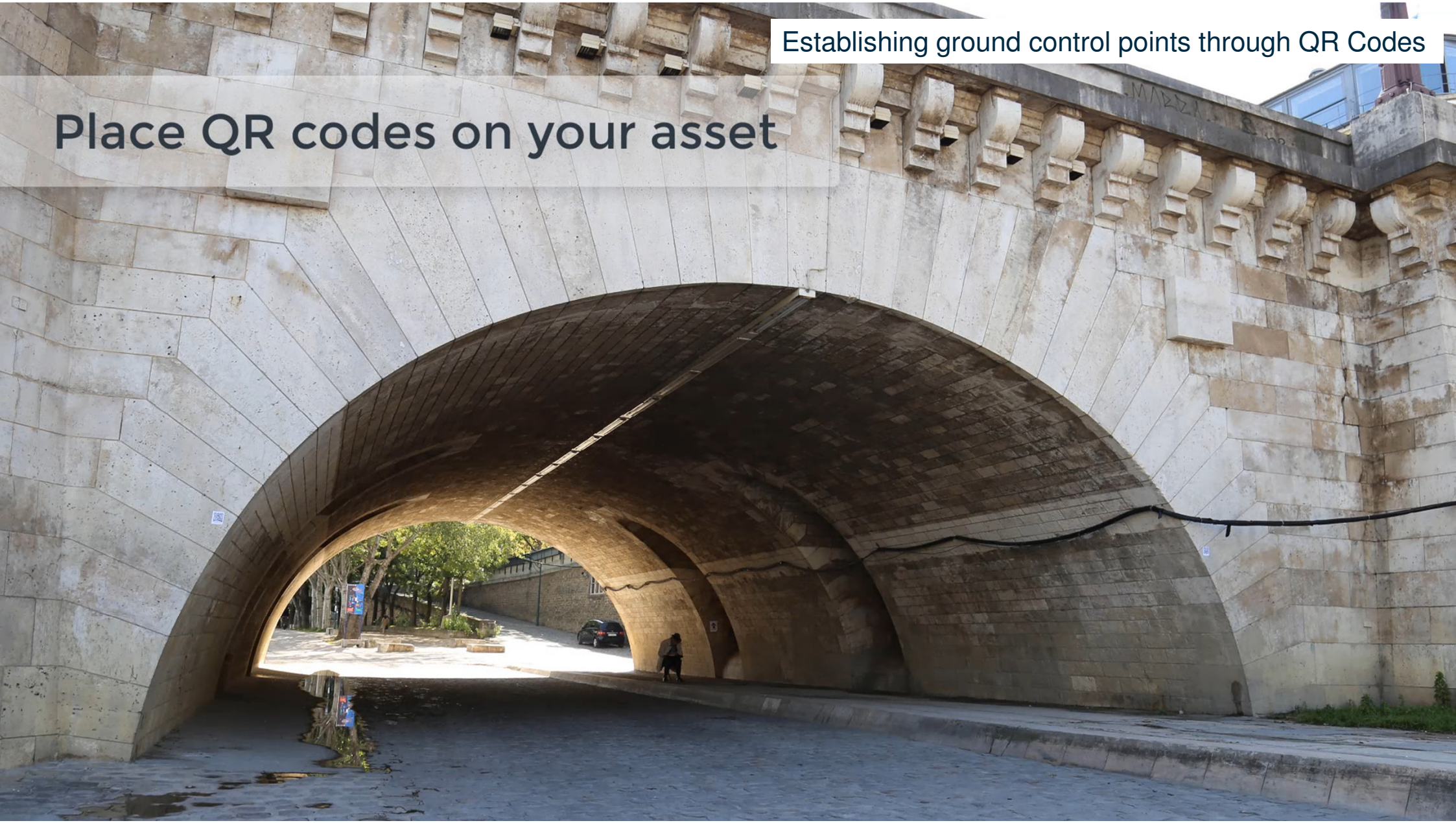

Resolution Mesh

ContextCapture – Update 5, 6 improvements

- New workflows
  - QR code framework to
    - Capture Ground Control points
    - Link reality mesh objects to an asset registry by identifying and locating objects in the scene
  - ProjectWise ContextShare integration (uploads output data)

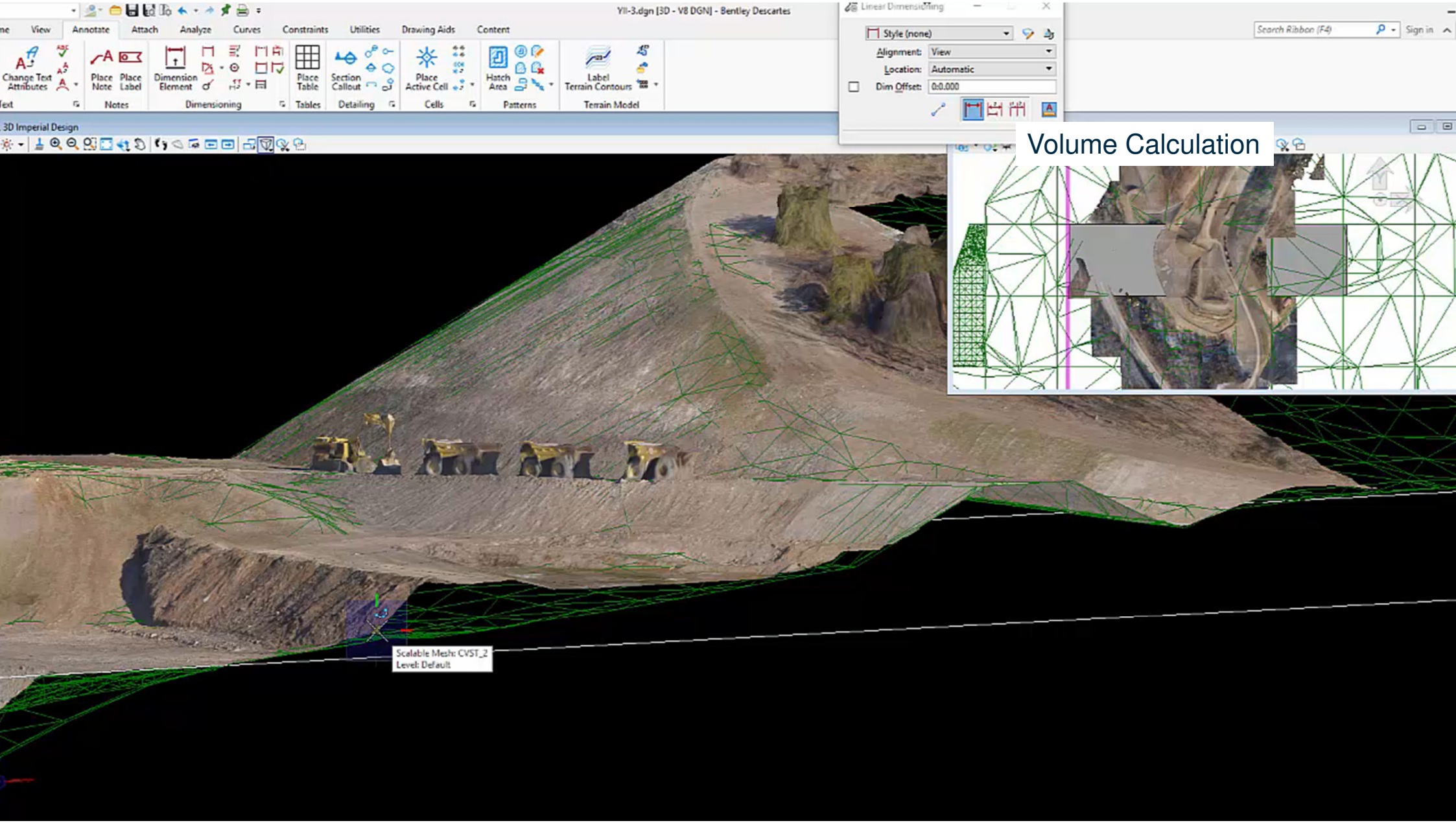
Locating Asset using QR Code

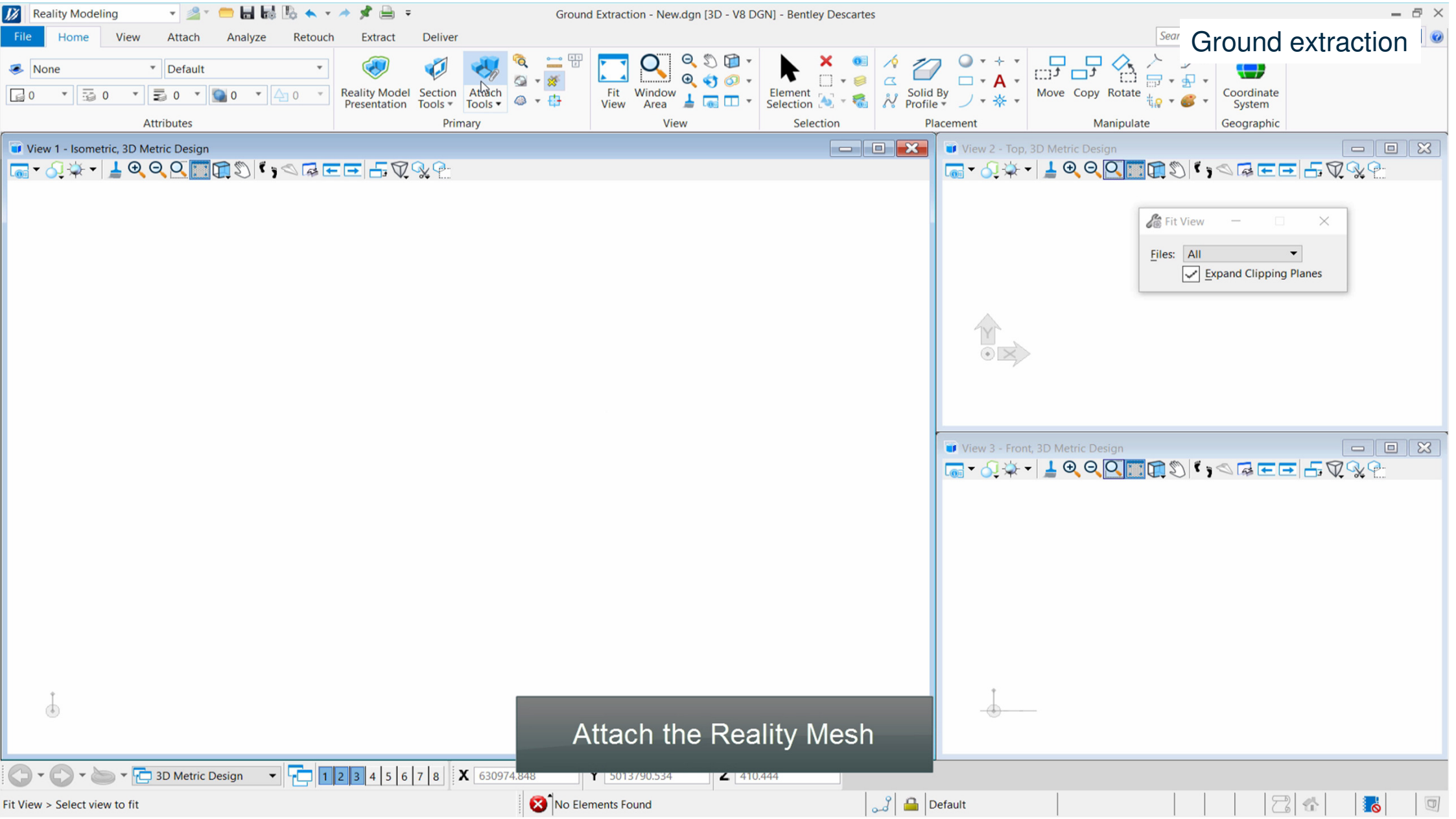
Place QR codes on your asset



Bentley ContextCapture Editor

- New tool allowing advanced functions on the ContextCapture output and more
  - Volume differencing of two Reality Meshes at full scale
  - Ground extraction on Reality Meshes and Point Clouds at full scale
  - Reality Mesh classification
  - Touch-up edits of Reality Meshes
  - Sectioning and break line extraction on Reality Meshes and Point Clouds
  - Geometric primitive extraction from Point Clouds
  - Create 2.5D Scalable Meshes from different sources
  - Upload Reality Mesh to ProjectWise ContextShare
  - Convert 3MX to 3SM/Web 3D tile formats
  - Advanced CAD tools
- Now included at no extra charge inside ContextCapture and ContextCapture Center


Yll-3.dgn [3D - V8 DGN] - Bentley Descartes
View
Annotate
Attach
Analyze
Curves
Constraints
Utilities
Drawing Aids
Content
Change Text Attributes
Place Note
Place Label
Dimension Element
Place Table
Section Callout
Place Active Cell
Hatch Area
Label Terrain Contours
Notes
Dimensioning
Tables
Detailing
Cells
Patterns
Terrain Model
Linear Dimensioning
Style (none)
Alignment: View
Location: Automatic
Dim Offset: 0:0.000
Search Ribbon (F4)
Sign in
3D Imperial Design
Volume Calculation
Scalable Mesh: CVST_2
Level: Default


Reality Modeling
Ground Extraction - New.dgn [3D - V8 DGN] - Bentley Descartes
File
Home
View
Attach
Analyze
Retouch
Extract
Deliver
Ground extraction
Reality Model Presentation
Section Tools
Attach Tools
Fit View
Window Area
Element Selection
Solid By Profile
Move
Copy
Rotate
Coordinate System
Attributes
Primary
View
Selection
Placement
Manipulate
Geographic
View 1 - Isometric, 3D Metric Design
View 2 - Top, 3D Metric Design
Fit View
Files:
All
Expand Clipping Planes
View 3 - Front, 3D Metric Design
Attach the Reality Mesh
3D Metric Design
Fit View > Select view to fit
No Elements Found
Default

ContextCapture Update 7 Improvements

- Better user feedback common errors (out of memory, etc.)
  - Reduce the need for the log viewer
- More than 30% faster than update 5

Available soon in Q4 2017

Bentley

More than 30% faster

Comparing CC Update 5 and Update 7			
Description	CC Update 5 Time (Seconds)	CC Update 7 Time (Seconds)	Speed-up Gain
Paris Structured Aerial 13.5 Gigapixels	70172 sec	41872 sec	40%
Sirius - UAV Aerial 7 Gigapixels	27862 sec	16359 sec	41%
Museum - Ground photos 12 Gigapixels	57822 sec	33014 sec	43%
Lorsch - UAV Aerial field 24 Gigapixels	95817 sec	53103 sec	45%
Boisseroles - Street photos 10 Gigapixels	70644 sec	35505 sec	50%

Bentley

GeoSLAM and Bentley Systems join forces to take mobile reality modelling indoors

Speed

SLAM technology enables rapid handheld mobile mapping of any environment without the need for GPS or expensive motion sensors. Up to 20 times faster than static or traditional survey techniques

Simplicity

On/off operation and simultaneous acquisition of laser data and imagery. The system requires minimal training and you do not need to be a surveyor to operate.

Quality

The GeoSLAM ZEB REVO produces accurate mapping for indoor, difficult to access or challenging environments. Realtime onsite processing provides immediate feedback on data quality and coverage.

Walk and

Photogrammetry mesh

01

Anyone can quickly and simply create reality models of their building, site, or facility without the need of a surveyor

02

Rapid mapping and modelling of indoor environments that often prove to be a challenge for photogrammetry alone due to a lack of texture change

03

Develop accurate hybrid models at unparalleled temporal resolutions for use in engineering and GIS workflows

Go anywhere Reality Modelling is here!

Bentley

Case study: Belsay Castle UK

Heritage documentation by historic England using GeoSLAM ZEB-REVO

Lighting rig accessory also

Textured reality model from 10 minute survey of castle interior using ZEB-REVO

Bentley

Data Courtesy of GeoSLAM

ContextCapture Update 8 Improvements

- Added new ability to only use photos for texturing and not 3D reconstruction – useful for Photo + Laser Scanner combined
- Acute3D viewer now support imperial units (US survey feet)

Future directions



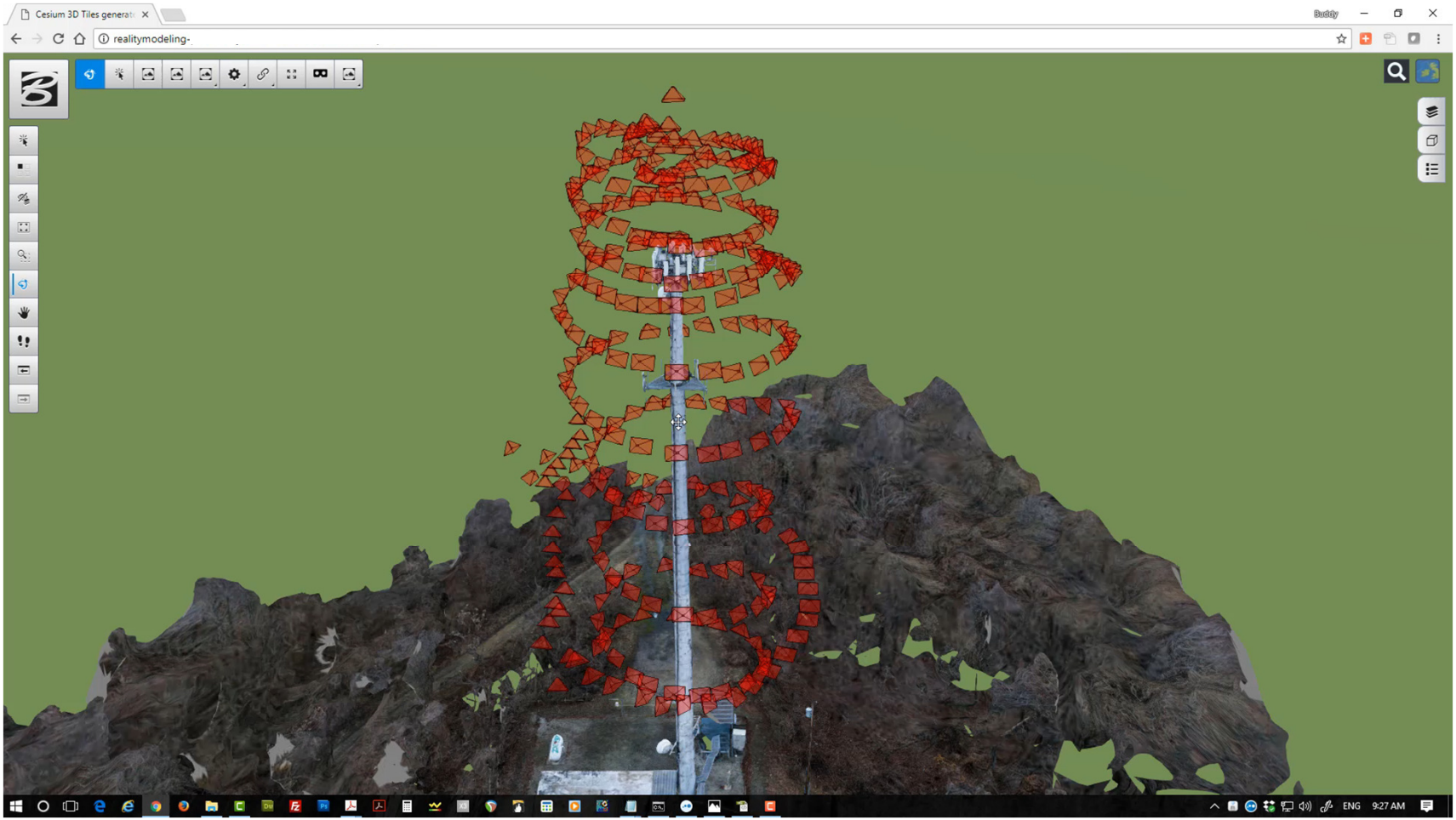

Development future directions

- ContextCapture On-Premise
  - Speed, speed, speed and more speed
  - Improve aerotriangulation
  - Improve reconstruction
  - Improve ease of use
- Reality Modeling Cloud Services
  - Accessible in more geographies
  - Bridge gap with On-Premise offering

Development future directions

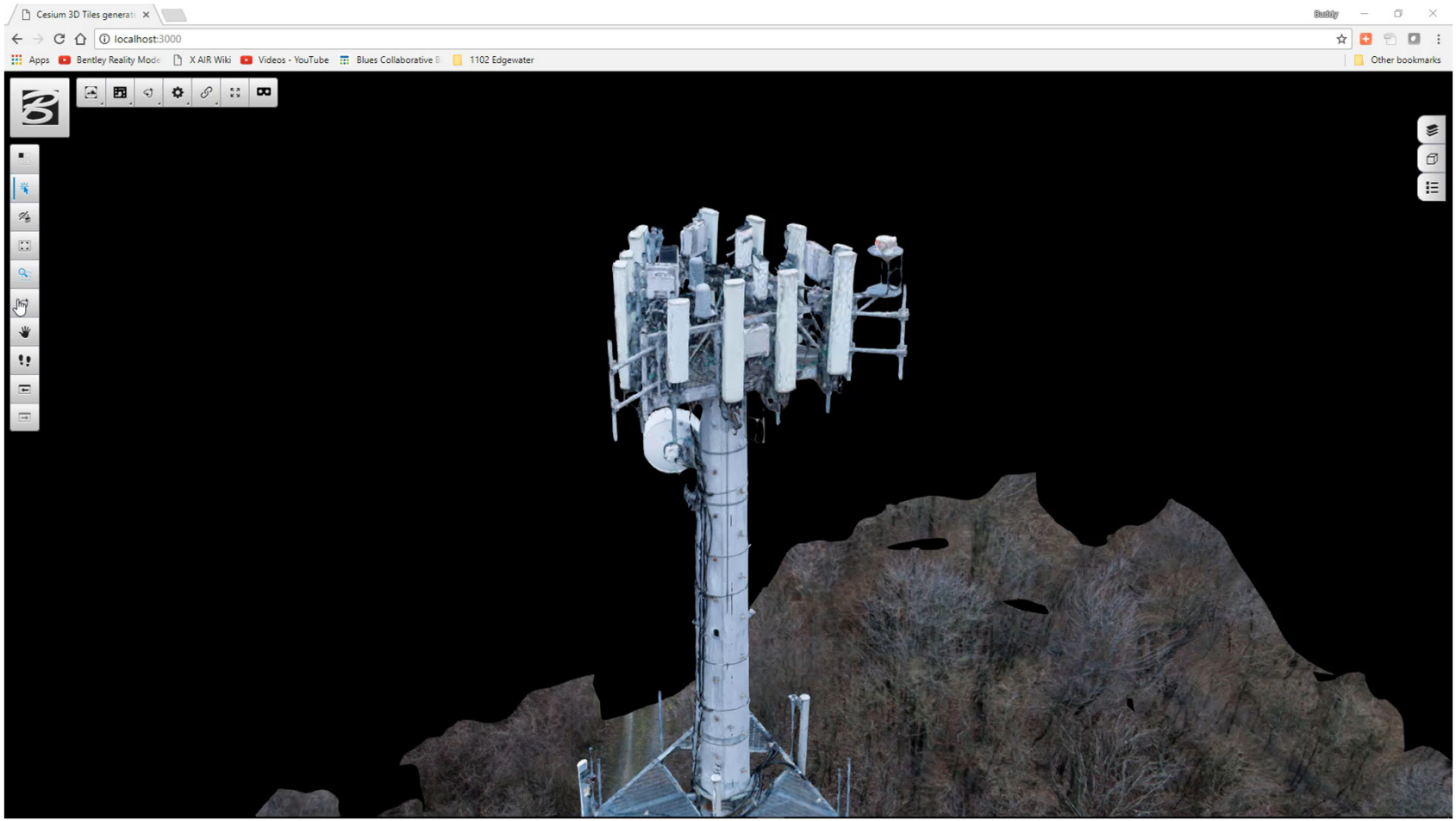
- Continued Integration with Design products and iModel Hub
- Operationeering/Inspectioneering offering
  - Web application
  - Linking with external 3rd party asset database
  - Web base Reality Mesh classification
  - Visual defect identification
  - Smart image navigation mode
  - R&D on using Artificial Intelligence (Deep Learning)
- Construction monitoring functionality

Web Photo Navigation



Bentley

Web Reality Mesh Classification



Bentley

Development future directions

- Construction monitoring functionality
- Expose most of our development API publicly
- Continue integration of reality data in other Bentley products and facilitate third party application integration


Bentley
Sustaining Infrastructure