Bentley
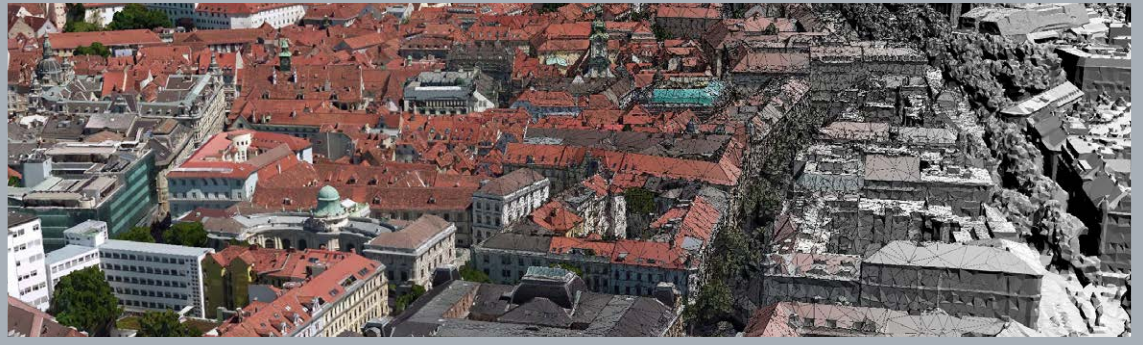*Advancing* Infrastructure

CONNECT Edition

ContextCapture
Automatically Create Digital Context for Digital Twins

McKiT
Solutions for Success
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Create 3D Engineering-ready Reality Meshes

ContextCapture enables you to use ordinary photographs to cost effectively produce 3D models of the most challenging conditions for every infrastructure project. For additional accuracy, adding point clouds from laser scans results in fine details, sharp edges, and geometric precision. You can quickly create and use these highly detailed 3D reality meshes to provide precise real-world context for design, construction, and operations decisions throughout the lifecycle of projects. ContextCapture allows you to reliably and quickly produce 3D models of any scale, from objects measuring a few centimeters to entire cities. The precision of the resulting 3D model is only limited by the image resolution you use.

Affordable, Precise 3D Models

ContextCapture enables you to develop precise reality models quickly, which keeps you from needlessly spending resources on extra equipment and training. You can simply use your smartphone camera to capture images.

Confidence to Model any Scale Project

ContextCapture's general-purpose computation on graphics processing units (GPGPU) as well as its multicore computing enables you to reliably deliver highly detailed models of any scale faster than ever. ContextCapture processes about 50 gigapixels per day, per computer.

Integrate Models into any Workflow

Access and share these richly photo-textured 3D models of existing conditions in any CAD or GIS workflow on desktop and mobile devices in many formats, including native use within MicroStation® and other Bentley applications.

Integrate Georeferenced Data

ContextCapture natively supports several types of positioning data, including GPS tags and control points. It can also incorporate any other positioning data through position/rotation import or complete block import, enabling you to precisely measure coordinates, distances, areas, and volumes.

Perform Automatic Aerotriangulation and 3D Reconstruction

Once the relative position and orientation of each photo has been automatically identified, you can make fine adjustments to the aerotriangulation results by adding control points and editing tie points to maximize geometric and geospatial precision. The optimized 3D reconstruction algorithms produce precise 3D models

Image courtesy of CEDARVILLE Engineering.

Easily perform cut and fill volume calculations in your 3D engineering-ready reality meshes.

and photo texturing of each mesh facet with unmatched accuracy. Because the application ensures optimal placement of 3D mesh vertices, ContextCapture recovers finer details and sharper edges with fewer artifacts, significantly improving geometric accuracy.

Generate 2D and 3D GIS Models

With ContextCapture, you can produce accurate georeferenced 3D models in a full range of GIS formats, including true orthophotos and Cesium 3D Tiles, with tiling and aerotriangulation export to KML and XML. The application includes a coordinate system database interface to ensure interoperability with your GIS solution of choice. You can select from more than 4,000 spatial reference systems and add user-defined ones. Moreover, ContextCapture automatically adapts the resolution and precision of the model to the resolution and spatial distribution of input data.

This means ContextCapture can handle scenes with non-uniform resolution without requiring trade-offs in the overall efficiency to preserve a few higher-resolution scene regions.

Touch up your reality mesh

You can take advantage of ContextCapture's quality control and individually tag your tiles of interest for touch-up. A variety of mesh selection modes such as rectangular, lasso, or a smart selection tool can help you touch up your targeted mesh facets, and automatic touch-up tools can remove small objects or fill holes.

Bentley's ContextCapture provides precise real-world context that can be applied to all phases of an asset lifecycle.

Reality Modeling for Design, Construction, and Operations Workflows

DESIGN

Image courtesy of Brown University.

CONSTRUCTION
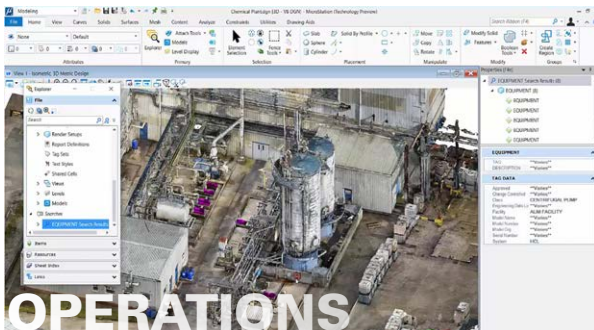
OPERATIONS

Advanced Processing for Reality Modeling Data

Work with Reality Meshes

ContextCapture Editor enables fast and easy manipulation of meshes of any scale, as well as the generation of cross sections, extraction of ground and breaklines, and production of orthophotos, 3D PDFs, and iModels. You can integrate your meshes with GIS and engineering data to enable an intuitive search, navigation, visualization, and animation of that information within the visual context of the mesh.

Work with Point Clouds

Point clouds can be enriched, segmented, classified, and combined with engineering models. You can then leverage ContextCapture Editor's capabilities for advanced 3D modeling, cross sectioning, breaklines, and ground extraction to model as-built conditions quickly and efficiently. As a result, you can improve point-cloud evaluation and produce more accurate engineering models. You can also produce animations and renderings for presentation.

Produce and Work with Large, Scalable Terrain Models

Create very large scalable terrain models from many sources including point clouds, breaklines, raster digital elevation models, and existing triangulated irregular networks. Scalable terrain models are always up to date, as they synchronize with the original data sources. This adds value through a global, current, integrated representation of all your data that can perform analyses using a variety of display modes.

Generate 3D CAD Models

Produce 3D models using a full range of CAD formats, 3D-neutral formats, digital surface models, and dense 3D point clouds to ensure your models are accessible in your modeling environment. In addition, you can produce multi-resolution meshes made of billions of triangles natively supported within Bentley applications, including MicroStation, Descartes, OpenBuildings™ Designer, OpenRoads™, OpenPlant®, OpenCities® Map™, OpenUtilities® Substation™, and many others.

Publish and View Web-ready Models

ContextCapture allows you to produce models of any size that are optimized for web publishing. You can use the web-ready scalable mesh format in iTwin® applications or the Cesium 3D Tiles GIS open format in a web browser, enabling instant sharing of 3D models with any stakeholder.

CAPABILITIES	CONTEXTCAPTURE	CONTEXTCAPTURE CENTER	CONTEXTCAPTURE CLOUD PROCESSING SERVICE
Imagery dataset size per project	Up to 300 gigapixels	Unlimited	Unlimited
Scanned point clouds limitation per project	3 billion	Unlimited	Unlimited
Mesh export formats (3MX/3SM/DGN/I3S/OBJ/FBX/STL/DAE/OSGB/Cesium)	*	*	* except STL, DAE and OSGB
Colored point cloud export (POD/LAS)	*	*	*
True orthophoto / 2.5D digital surface model (TIFF/GEOTIFF/KML)	*	*	*
Georeferencing	*	*	*
Parallel (cluster) processing for unlimited scalability	Up to 2 engines	*	Up to 20 engines per project
ContextInsights automatic detection	*	*	
Software development kit	*	*	
Process several jobs in parallel	Up to 2	*	*

> *"Reality modeling is becoming business as usual for MMC Gamuda and that is a real testament to the ease of using ContextCapture."*
>
> — Ronan Collins, Head of Project Information Management, MMC Gamuda
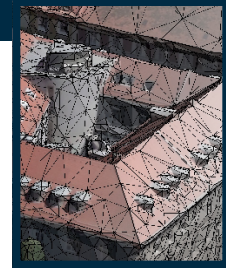
Reality Modeling Solutions to Fit Your Business Needs

Depending on your reality modeling workflow needs, ContextCapture is available as an on-premises or cloud-based service solution. ContextCapture has three main modules: Master, Engine, and Editor. The Master module provides a graphical user interface that allows you to define input data and processing settings, submit processing tasks, monitor progress, and visualize results. The Engine module runs on a computer in the background without user interaction and performs computationally intensive algorithms. This master-worker pattern allows ContextCapture to support grid computing and dramatically reduces processing time by running multiple ContextCapture engines on multiple computers and working on a shared job queue. ContextCapture Editor is a 3D CAD module for editing and analyzing reality data and is included with ContextCapture and ContextCapture Center.

You can quickly produce reality meshes with your local machine or upgrade to ContextCapture Center to save time by employing scalable computing power that speeds production of your 3D models by leveraging the latest parallel computing systems.

ContextCapture Center

When creating extremely large models, you can take advantage of greater computational power with ContextCapture Center. It leverages grid computing to dramatically speed processing time by running multiple engines on several computers and associating them to a single job queue. If you have projects larger than 300 gigapixels of imagery, use ContextCapture Center to seamlessly handle terabytes of input imagery.

You can speed production with the latest computing systems for desktop and cluster processing units, including GPU computing, multicore computing, advanced bundle block adjustment, tiling mechanisms, task queuing and monitoring, grid computing, and ultra-large project management.

ContextInsights

With ContextInsights, you can automatically detect and locate objects in your 3D reality meshes using 3D machine-learning technology. This feature can automatically detect and extract intelligence from your reality data, including:

- 3D objects that can serve asset inventory workflows (e.g.: telecommunication antennas).
- Shapefiles or segmented orthophotos to represent the ground occupation of large scale scenes (e.g.: building footprints).
- Segmented LAS point clouds for a more structured deliverable and to assist your digitalization work.

With the ContextCapture mobile app, you can quickly create 3D models using images from your phone.

Image courtesy of Eye-bot Aerial Solutions

INSPECTION

Reality modeling for inspections provides key information, saves time, reduces costs, and minimizes the risk of injuries.

Why ContextCapture?

ContextCapture is ideal for infrastructure projects throughout design, construction, and operations. Its power, flexibility, and scalability turn simple photographs and point clouds into true-to-life, highly detailed 3D cities quickly and with precision. ContextCapture is used by leading design, construction, mapping, and surveying professionals including Nearmap Asia Air Survey, Airbus Group, and many more in Europe, America, and Asia to generate high resolution, photorealistic 3D models.

Reality Modeling Cloud Services

ContextCapture Cloud Processing Service enables you to upload photos and/or point clouds to quickly generate 3D engineering-ready reality meshes, orthophotos, digital surface models, and point clouds leveraging extended engine parrallelization offered by our service.

Without the need for high-end hardware requirements or IT constraints, you can simplify and scale your projects, allowing anyone on your team to easily document as-is situations affordably and with less investment of time and resources, reducing your costs. Using a desktop or mobile application, you can access the cloud processing service.

ContextCapture Cloud Processing Console

This console enables you to instantly upload images, define your ContextCapture settings such as ground control and/or point clouds, and create a 3D reality mesh using the latest cloud technology.

ContextCapture Mobile

With this easy-to-use reality modeling app, you can quickly create 3D models using images taken with your phone or tablet and display the model on your device. ContextCapture Mobile is available on iOS and Android.

ProjectWise ContextShare is a reality modeling data sharing service that allows you to securely manage, store, and share large amounts of reality modeling data.

Working in a connected data environment improves your workflow by sharing and syncing your reality modeling data instantly across project teams and applications.

Reality Data Web Viewer

This web-based collaborative viewer adds value to your reality meshes. You can easily link your reality mesh with asset data and annotate your scene.

Find out about Bentley at: www.bentley.com

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**Global Office Listings**
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Bentley®
Advancing Infrastructure

"Bentley's ContextCapture allows us to very easily process hundreds of images taken by drone or handheld digital camera into a 3D reality mesh that can then be consumed inside Bentley's OpenRoads™ products to speed our civil engineering design work."

— Christopher B. Burke, Ph.D., PE, D.WRE, Dist.M. ASCE, NAC, President, Christopher Burke Engineering, Ltd.
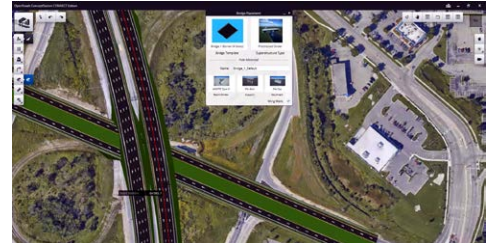
Road design leveraging a reality mesh in Bentley's OpenRoads™ ConceptStation.

ContextCapture At-A-Glance

Input
- Multiple camera project management
- Multi-camera rig
- Visible field
- Infrared/thermal imagery
- Videos
- Laser point cloud (3 billion points for ContextCapture, unlimited for ContextCapture Center)
- Surface constraints: imported from a third party or automatically detected using artificial intelligence
- Metadata file import
- EXIF

Calibration / Aerotriangulation (AT)
- Automatic calibration / AT / bundle adjustment
- Parallelization ability on ContextCapture, ContextCapture Center, and ContextCapture Cloud Processing Service
- Project size limitation (300G PIX for ContextCapture, unlimited for ContextCapture Center)
- Control points management
- Block management for large AT (only available with ContextCapture Center)
- Quality report
- Lasers can/photo automatic registration
- Splats display mode

Georeferencing
- GEOCS management
- Georeferencing of generated results
- QR codes, April tags, and Chili tags: Ground control points automation

Scalability
- Tiling
- Cluster enabled

Computation
- GPU based
- Multi-GPU processing based on Vulkan (optional)
- Background processing
- Scripting language support / SDK
- ContextCapture Cloud Processing

Editing
- Quality control enabling tiles tagging (only in ContextCapture Center)
- Integrated mesh touch-up capabilities

- Touch up capabilities using a third-party application (export/import of OBJ/DGN)
- Orthophoto visualization
- DEM / DSM visualization
- DTM extraction
- Cross sections
- Contour lines (with Scalable Terrain Model)
- Point cloud filtering and classification
- Breaklines extraction
- Modeling feature
- Support of streamed reality meshes
- Create scalable mesh from terrain data
- Volume calculation

Output and Interoperability
- Multiresolution mesh (3MX, 3SM, and Cesium 3D Tiles)
- Bentley DGN (mesh element)
- 3D CAD-neutral formats (OBJ, FBX)
- KML export (mesh)
- Esri I3S / I3P
- Other 3D GIS formats (SpacEyes, LOD Tree, OSGB)
- 3D PDF
- AT result export (camera calibration and photo poses)
- DEM / DSM generation
- True orthophoto generation
- Blockwise color equalization
- Point cloud (LAS, LAZ, PLY, and POD)
- Input data resolution texture mode
- AT quality report
- Animations (fly-through video generation)
- QR code for 3D spatial registration of assets

Viewing
- Free ContextCapture Viewer
- Web viewing

Measurement and Analysis
- Distances and positions
- Volumes and surfaces
- Input data resolution
- Photo-navigation
- Aerotriangulation quality metrics

Bentley CONNECT
- Upload to ProjectWise® ContextShare
- Reality mesh streaming from ProjectWise ContextShare
- Associate to CONNECT projects
- CONNECT Advisor