Going Digital: Reality Modeling Advances Surveying, and Engineering…

Greg Bentley, CEO, Bentley Systems

May 30, 2017
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Going Digital: Reality Modeling Advances *Surveying*, and Engineering…

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May 30, 2017
Advancing Infrastructure…
Going Digital: Reality Modeling Advances Surveying, and Engineering…

May 30, 2017
Construction constitutes 13% of Global GDP but productivity growth remains dramatically low.

Source: Imagining Construction’s Digital Future
Capital Projects and Infrastructure
June, 2016
McKinsey Productivity Sciences Center, Singapore

1 Real (2005 USD) gross value added per hour worked by persons engaged, indexed 1995 = 100, 20-year CAGR

Source: 
Imagining Construction’s Digital Future 
Capital Projects and Infrastructure 
June, 2016 
McKinsey Productivity Sciences Center, Singapore

![McKinsey Global Institute Industry Digitization Index]

Relatively low digitization
Relatively high digitization

Digital leaders within relatively undigitized sectors

**Sector**
- ICT
- Media
- Professional services
- Finance and insurance
- Wholesale trade
- Advanced manufacturing
- Oil and gas
- Utilities
- Chemicals and pharmaceuticals
- Basic goods manufacturing
- Mining
- Real estate
- Transportation and warehousing
- Education
- Retail trade
- Entertainment and recreation
- Personal and local services
- Government
- Healthcare
- Hospitality
- Construction
- Agriculture and hunting
ARC Global Market Research Study, August, 2016
“Engineering Design Tools for Plants and Infrastructure”

#1 Water and Wastewater Distribution

#1 Electric Transmission & Distribution, and Communications Systems

#2 Power Generation

#2 Software as a Service

#2 Engineering Design Tools for Plants and Infrastructure
ARC Global Market Research Study, October 2, 2015

“Asset Reliability Software and Services”

#1 Reliability Software for Water and Wastewater

#1 Reliability Software for Electric Power T&D

#1 Reliability Software for Other Industries

#2 Reliability Software Revenue

www.arcweb.com
ARC Global Market Research Study, August, 2016

“Geographic Information Systems”

#2 Geographic Information Systems (GIS)

#1 Software as a Service
BUILD: THE FUTURE OF CONSTRUCTION

Proven management processes and innovative technology-enabled solutions—from drones to next-generation building-information modeling, digitization, and advanced data analytics—have the potential to boost construction productivity by 20 to 25 percent and increase profitability. What are the most tangible proven solutions to improve the outcomes and economics? How are leading companies overcoming the obstacles of fragmentation, cultural resistance, and risk aversion?

Panelists

Greg Bentley, Chief Executive Officer, Bentley Systems
Isabel Dedring, Global Transport Leader, Arup
Shaun Kenny, President, Asia Pacific, Bechtel

Moderator: Michael Della Rocca, Partner, McKinsey & Company
**Going Digital: Reality Modeling…**

1. **Higher-definition surveying and geolocation**
   - Rapid digital mapping and estimating

2. **Next-generation 5-D building information modeling**
   - Design platform for the future

3. **Digital collaboration and mobility**
   - Moving to paperless projects, from the office to the workforce

4. **The Internet of Things and advanced analytics**
   - Intelligent asset management and decision making

5. **Future-proof design and construction**
   - Designing with materials and methods of the future

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**Digital construction organization**

Developing next generation of digital-native leaders to deliver projects of the future

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**Source:**
*Imagining Construction’s Digital Future*
McKinsey, June, 2016
Reality Modeling (2015)…
Leica Geosystems selects Bentley’s Acute3D reality modeling software to further enhance its airborne imaging solutions

Solutions for both unmanned aerial vehicles and piloted aircraft to benefit from Acute3D’s Reality Mesh Representations

Exton, Pa., U.S.A. – October 7, 2015 – Bentley Systems, Incorporated, the leading company dedicated to providing comprehensive software solutions for sustaining infrastructure, today announced that Leica Geosystems will incorporate Bentley’s Acute3D reality modeling software into its advanced oblique airborne imaging solutions for both unmanned aerial vehicles (UAVs) and piloted aircraft. Leica Geosystems, a leader in geospatial data acquisition and mapping products, has selected Acute3D software to generate full 3D “reality mesh” representations from its airborne photogrammetric imagery. This combination of software and hardware advancements enables the company to take full advantage of integrated 3D surveying and mapping.
2015 Be Inspired Winner: Reality Modeling

Singapore Land Authority
Mapping Singapore in 3D

- Bentley Map
- Pointools
- ContextCapture
Creating Space Above and Below

Industry Space Above Roads

Underground Science City

Jurong Rock Caverns

Underground City - Singapore has many different types of rocks under its surface, from granite and porphyre, which are much harder than concrete, to limestone, which could be dissolved by rainwater. Here are some of the rock formations and a snapshot of Singapore's underground projects.
CityGML Model in Bentley Map Enterprise
3D Map Data – Needs are Growing

Development Planning

Urban Heat Island

Urban Air Flow Dynamic

Underground Infrastructure

DTM for Flood Management

Telecommunication Coverage
3D Mapping for Smart Nation
Building a smart city: How Singapore is forging a path ahead of the rest

Highway to Singapore's Smart Future

Singapore is striving to be the world's first 'smart city'
THE YEAR IN INFRASTRUCTURE 2017

October 10 – 12, 2017 | Marina Bay Sands | Singapore

REGISTRATION OPENS FEB. 21, 2017
WWW.BENTLEY.COM/YII2017
Going Digital: Reality Modeling Advances Surveying, and Engineering…

May 30, 2017
BIM Better Project Delivery
Better Project Delivery through Breadth of Information Mobility
Arup Singapore | Marina Bay Sands
Singapore

2010 Be Inspired Winner
Innovation in Structural Engineering

• Bentley Structural
• GenerativeComponents
• MicroStation
• ProSteel
• RAM
Designing

Simulating

Visualizing

Information Modeling

Analytical Modeling

Construction Modeling

Design Modeling

Information Mobility

Constructing
Better Asset Performance through Depth of Information Modeling

Better Project Delivery through Breadth of Information Mobility

OPEX

CAPEX
Better Asset Performance through Depth of Information Modeling

Better Project Delivery through Breadth of Information Mobility

OPEX

TOTEX

CAPEX
As Designed...
As Built...
Hannover Messe 2017
Siemens Pre-Press Conference
Karlsruhe, Germany
March 14, 2017
As Continuously Surveyed…

Change in location / Size of Panel

Pumps are different size
Partnership to include application development by Bentley for MindSphere
As (IoT) Connected...

Hannover Messe | Siemens Booth
April 25, 2017
BEST OVERALL

Context Capture (Bentley Systems)

"Enables maintenance professionals (as well as operations and engineering) to work in a realistic 3D visualization environment. Easy to use, easily modeling software creates 3D models of your assets. By photographing you take and using drones to take high resolution pictures. Establishes an immersive 3D environment for asset health monitoring, reliability and maintenance planning as well as work execution. Then with continuous surveying of your assets in the same way (drone or pics), software compares to baseline for changes.

Benefits:
• Quickly and easily create 3D models of your assets from photographs
• Pinpoint locations visually to know specifically where you need to inspect and/or address an issue
Be Inspired Awards
November, 2016

Reality Modeling
credited by:

15 Be Inspired Finalists
& 62 Nominees

www.Bentley.com/yearbook
Reality Modeling Goes Mainstream!

加速ContextCapture采用推动设计、施工和检验；混合输入现在拥抱扫描和照片

LONDON – The Year in Infrastructure 2016 Conference – 2 November 2016 – At this annual conference for infrastructure thought leaders, CEO Greg Bentley made the case in his Keynote that since Bentley Systems’ acquisition and assimilation of ContextCapture software in 2015, the proliferation of reality modeling across users’ projects—and across Bentley’s software portfolio.
Reality Modeling “Footprint” (2017 to date)
Corridor (Design)

2016 Be Inspired Finalist:
Reality Modeling

CH2M Fairhurst Joint Venture
A9 Dualling Program, UK
Campus (Construction)

2016 Be Inspired Finalist: Reality Modeling
Kano Laboratory, Waseda Univ., Obayashi Corp.
Automated Recognition of Work Progress, Japan
City (Operations)

2016 Be Inspired Winner: Reality Modeling
City of Helsinki
Helsinki 3D+, Finland
HELSINKI 3D+ 
A New Generation of City Models

Project Manager/ Architect/MSc (Civ.Eng.) Jarmo Suomisto
3D data of Helsinki since 1985 ...
1999 3D-simulator

LOD 2 + new developments

3D-model + game engine [RealiMation]

Real-time simulator in exhibitions

City of Helsinki / 3D City Information Model
2003 Pasila

3D model
Design alternatives
Real-time-simulator
New Challenges

- Visual WOW! is **not enough**
- Helsinki **SMART City** goals
- Broad **technological** development
- **CityGML-standard** and progress in European cities
- Need to have more **accurate data and analyzes**
- Need to **modernize** working methods
- **Open data** culture
- **Leap in the dark** with new technology
- First City within **Nordic** countries
HELSEINKI 3D+ UTILIZATION PILOTS PORTFOLIO

3D INFRASTRUCTURE
2. Model maintenance processes
3. Intranet Oblique Foto & LAS service

PROCESS DEVELOPMENT
4. CityGML/InfraModel/IFC Collaboration
5. 3D Virtual Parks / Tree derivation from LAS data
6. Underwater Citymodel / Kruunusillat Bridge

SMART SOLUTIONS
7. Citizen Interaction Platform / Serious Gaming
8. Underground Service Tunnel Marketing / Serious Gaming
9. Urban development energy use simulation

URBAN ANALYTICS
10. Quality indicators of Urban space / Aalto University
11. CO2 / GHG / Emission analyses / Low Carbon City Lab

City of Helsinki / 3D City Information Model
http://3d.hel.ninja/mesh/
Yellow Warning for Forest Fire

TODAY MAY 29
18°/4°C
Periods of clouds and sun

TUE MAY 30
12°/8°
Cooler with a shower or two

WED MAY 31
13°/4°
A brief shower or two

THU JUN 1
12°/4°
A brief shower or two
Going Digital: Bentley Systems Advances Reality Modeling to Extend the Scope of Engineering and Surveying Value

Combination of New ContextCapture Services and ProjectWise ContextShare Comprehensively Deliver Fidelity, Accessibility, Scalability, and Shareability

Houston, TX – SPAR 3D Expo & Conference – April 3, 2017 – Bentley Systems, Incorporated, a leading global provider of comprehensive software solutions for advancing infrastructure, demonstrated at SPAR 3D Expo & Conference (SPAR) new ContextCapture offerings for reality modeling that increase joint opportunities in surveying and engineering. ContextCapture capabilities now include cloud processing services, a mobile app, and photo planning for Bentley’s applications. ContextShare extends Bentley’s ProjectWise connected data environment to securely manage, share, and stream reality meshes, and their input sources, across projects, teams, and applications. Navigator Web is a new web application that delivers high-performance streaming of very large reality meshes through the browser to desktop or mobile devices.
No photos added
Click on Add photos to add some
Reality Modeling Advancements (2017)

ProjectWise
ContextShare

ContextCapture
cloud processing

ContextCapture
Mobile
Navigator Web

ContextCapture:
- photo planning
- hybrid processing
Redevelopment of London Bridge Station ensuring the station remains fully operational.

ContextCapture
Scalable, Geo-referenced 3D Reality Model

Minimised on-site work, maximised capture
Time saved and Safety improved
Better Surface Definition

Photo Only
The Capture

GeoSLAM’s engineer using a ZEB-REVO scanner
Better Surface Definition

Photo Only
Better Surface Definition

Photo and Laser Scanner

London Bridge Station
Better Surface Definition

Photo and Laser Scanner

London Bridge Station
Improves Non-textured Surface Reconstruction Quality

Photo Only
Improves Non-textured Surface Reconstruction Quality

Photo and Laser Scanner
Improves Non-textured Surface Reconstruction Quality

Photo and Laser Scanner
Thermography (from UAV)…
Reality Modeling (2017)…
Going Digital: Reality Modeling Advances *Surveying*, and Engineering…
Conceptioneering!
Urban Planning with Reality Modelling in historical cultural blocks protective renovation project
(Harbin City)
China Northern Industrial University | IFA Technology
Urban Planning with Reality Modelling in historical cultural blocks protective renovation project
(Harbin City)
China Northern Industrial University  |  IFA Technology
Going Digital: Reality Modeling Advances Surveying, and Engineering...
Surveying  Engineering  Construction
Constructioneering!
Bentley Systems and Topcon join forces to advance cloud services for ‘constructioneering’

Engineers’ connected data environments will span survey and construction processes for comprehensive project delivery benefits

LONDON – The Year in Infrastructure 2016 Conference – 2 November 2016 – Topcon Positioning Group, a world leader in positioning instruments for survey and construction, and Bentley Systems, a leading global provider of comprehensive software solutions for advancing infrastructure, today announced their joint intentions to connect cloud services for constructioneering. During the keynote presentations, the companies’ CEOs presented new construction workflows designed to increase efficiency and productivity with enhanced integration between their respective cloud services.

Each company will bring to market cloud-based solution offerings, which include services of both and provide construction workflows not previously possible. Initially, Bentley Systems will integrate Topcon’s cloud services into the and vice versa, effectively expanding the capabilities of the respective solutions.

Ray O’Connor
CEO, Topcon Positioning Systems
Year in Infrastructure
November, 2016
Going Digital: Reality Modeling Advances Surveying, and Engineering…
Inspectioneering!
Going Digital: Reality Modeling Advances Surveying, and Engineering…

[Image of diagram with labels: Project Delivery, Concepteering, Productioneering, Inspectioneering, Constructioneering, Asset Performance]
Productioneering!
Virtual Penn State

John Messner, Ph.D.
Charles and Elenor Matts Professor of Architectural Engineering
Director, Computer Integrated Construction Research Program
Penn State
Making It Real

2,400 + Photos — 2 hours to Capture

Orbiting over PSU & acquiring data
Four Steps to the digital twin
FIG WORKING WEEK 2017

Surveying the world of tomorrow – From digitalisation to augmented reality

May 29 - June 2
Helsinki Finland
Going Digital: Reality Modeling Advances…

PROJ ECT DELIVERY

ASSET PERFORMANCE

Conceptioneering

Productioneering

Constructioneering

Inspectioneering
Going Digital: Reality Modeling Advances Engineering…
Going Digital: Reality Modeling Advances Surveying and Engineering!
How can we Help You with your surveying, 3D modelling or mapping requirements?

Contact Us
Projects & Experience
A sample of our latest work

Interested in discussing how we can help with your next project?

Contact Us
Projects & Experience

A sample of our latest work

Interested in discussing how we can help with your next project?

Contact Us
The Great Southern Motorplex Group are working towards establishing a world class motorplex in the Albany region. After securing a suitable location the working group required a complete survey of the stage 1 region to begin the planning. Albany Mapping & Surveying Services deployed its UAV Aerial Mapping system to collect high accuracy data over the whole 100ha area in a single morning. The collected data was then processed to produce a 3D reality model, Contour & Feature Survey, DEM (Digital Elevation Model) and string digital model. This data can now be used for preparing detailed engineering design and 3D concept plans and presentations.

Inspect the 3D Reality Model below (click and drag) or the full screen model here.
“…We are currently preparing a quote to complete image capture (and preferably also processing) of the complete Worsley Alumina Refinery in high detail.

Please see below a very small sample of data we collected and processed. This is the result of only 56 images from the total 150 images collected of this pipe work. The total capture was 800 UAV photos and 3000 ground photos (captured in 5hrs). The final model promises to be stunning…”

Christopher Stan-Bishop
Surveyor / Partner
B.Surv Hon, M. SSSI, M. WAIS
“Our survey work has traditionally been limited to an initial survey prior to new works and a support role during construction. With reality modeling, we have decreased our turnaround times, enhanced our deliverables and added new business which is ongoing and recurring through an asset’s continuous lifecycle. End user clients are realizing significant cost savings causing an increasing demand for our services.”
FIG 2017 Working Week…

Technical Session:

**Bentley Map Meets Reality Modeling**
by Johannes Klick

When: **Wednesday, May 31, 11:00 am – 12:30 pm**
Where: **Room 208**

Product demonstration:

**Reality Modeling Goes Mainstream**
by Aidan Mercer/Pascal Martinez

When: **Wednesday, May 31, 1:45 pm – 02:30 pm**
Where: **Exhibition Hall Stage**
Laituri - Towards tomorrow's Helsinki

http://laituri.hel.fi/info

Helsinki has become a metropolis! – Eliel Saarinen and Helsinki

Exhibition at Laituri: June 1 to September 16, 2017
Going Digital: Reality Modeling Advances Surveying, and Engineering…

May 30, 2017
Reality Modeling Advancements (2018…)

Machine-Learned Classification: Grass, Tree, Car
Going Digital: Resolution “Provenance”…
Going Digital: Resolution “Provenance”…

Photo resolution:
From 35mm to 50mm per pixel from 15mm/pixel
Going Digital: Resolution “Provenance”…

+ 150 photos

Resolution: from 15mm/pixel
Going Digital: Reality Modeling Advances *Surveying*, and Engineering…

May 30, 2017