A man in a dark suit and tie is pointing his right index finger towards a digital grid overlay. The grid is composed of blue dots and lines, forming a perspective view. In the background, a city skyline at night is visible, with the Oriental Pearl Tower in Shanghai being prominent. The overall scene is illuminated with blue and purple light, creating a futuristic and technological atmosphere.

Advancing Construction Projects through reality 3D modeling and collaboration.

Rajathurai, Sr.Manager, Product Success, Bentley Systems

Capital Projects and Infrastructure

June, 2016

McKinsey Productivity Sciences Center

Singapore

McKinsey&Company

Imagining construction's digital future

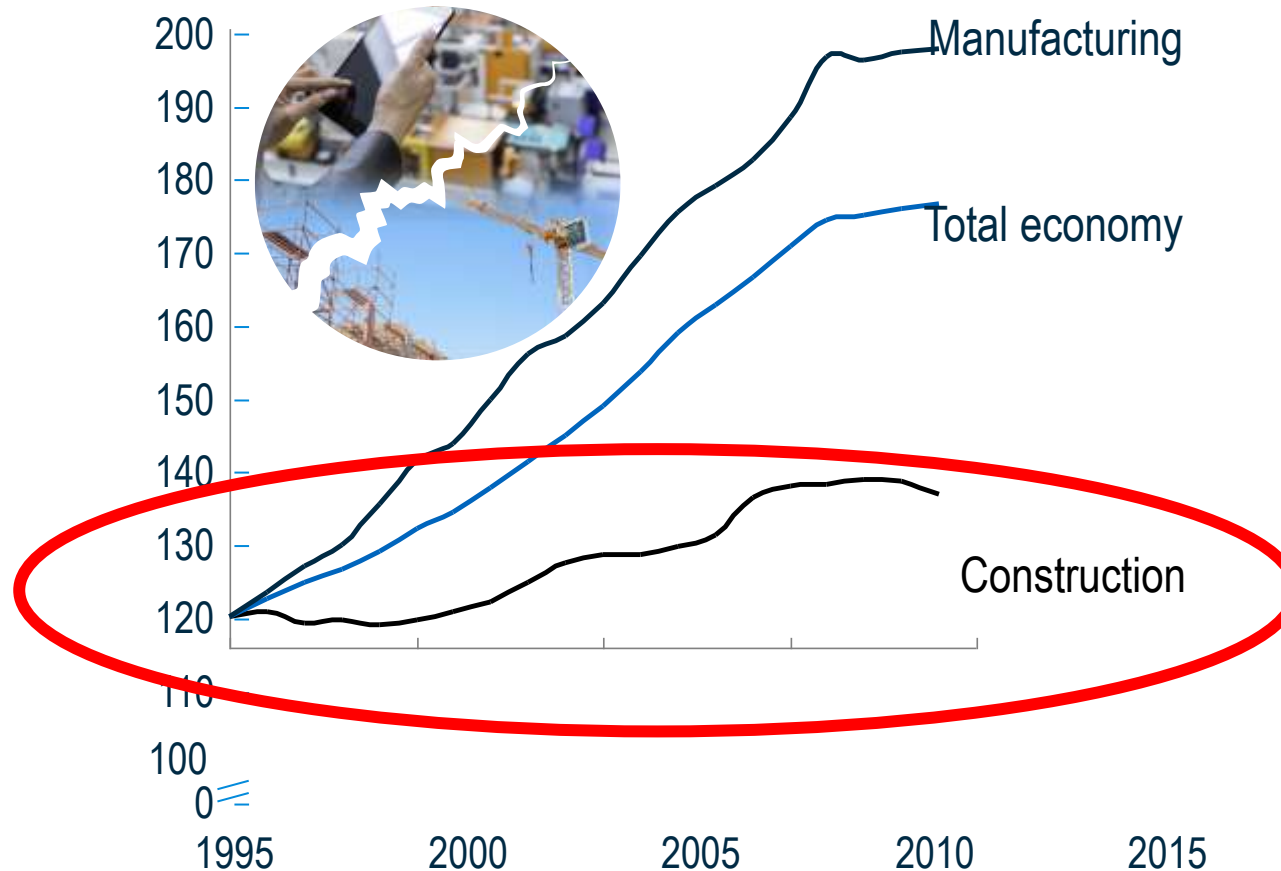
Capital Projects and Infrastructure June 2016
McKinsey Productivity Sciences Center, Singapore



Rajat Agarwal
Shankar Chandrasekaran
Mukund Sridhar

Construction constitutes 13% of Global GDP but productivity growth remains dramatically low

Global productivity growth trends
Real gross value added per hour worked
by persons engaged, indexed 1995 = 100

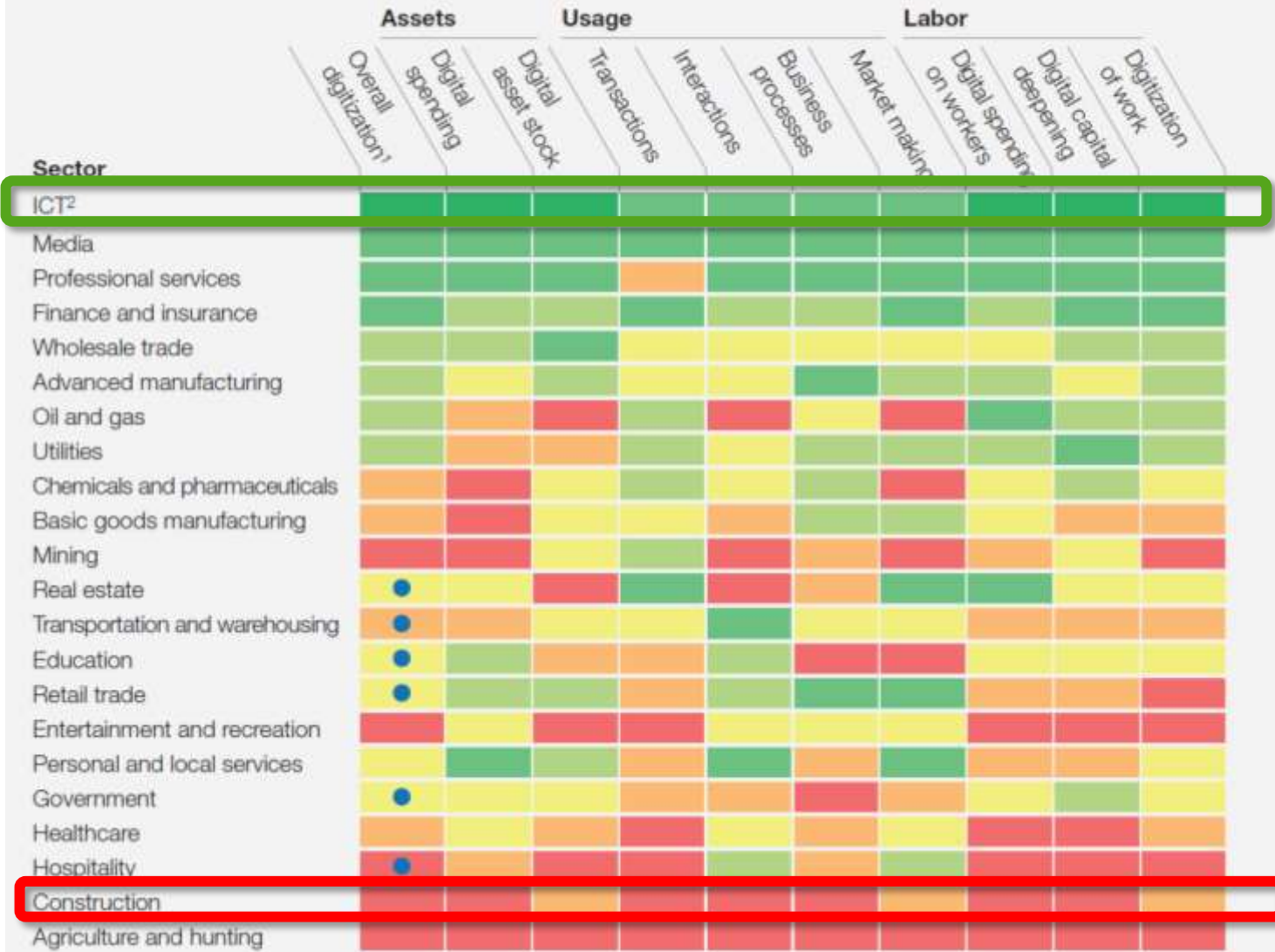


1 Real (2005 USD) gross value added per hour worked by persons engaged, indexed 1995 = 100, 20-year CAGR

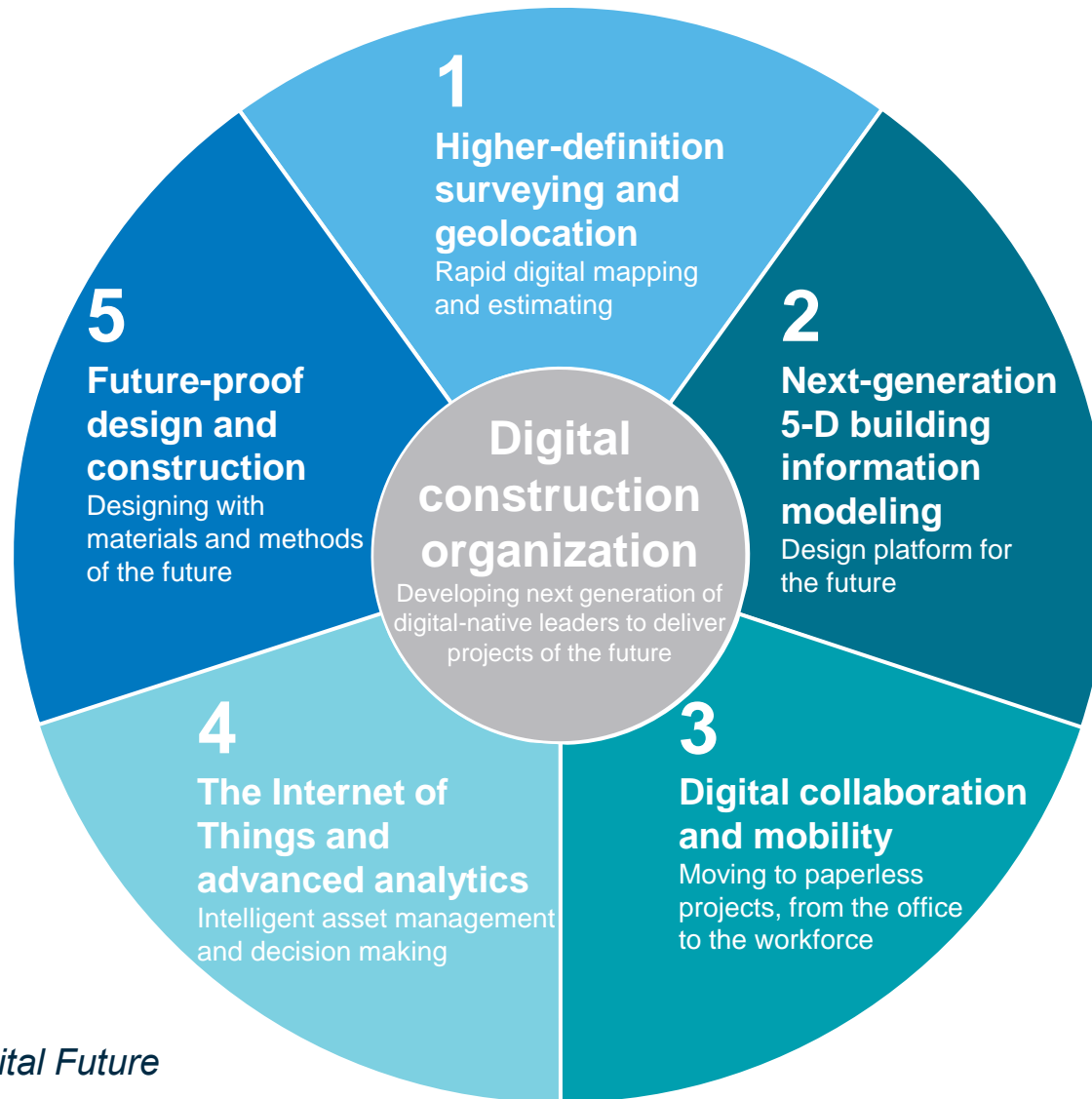
SOURCE: OECD, WIOD, GGCD-10, WorldBank, US BEA/BLS, Turkish National Statistics Bureau, Singapore National Statistics Agency, Malaysian Statistics Agency, Rosstat, McKinsey Global
© 2017 Bentley Systems, Incorporated, Global Insight; ISSA

McKinsey Global Institute **industry digitization index;**
2015 or latest available data

Relatively low digitization  Relatively high digitization
● Digital leaders within relatively undigitized sectors



Going Digital...



Source: *Imagining Construction's Digital Future*
McKinsey, June, 2016

OPEX

Better
Asset
Performance

through
Depth of
Information
Modeling

BIM

Better **Project Delivery**
through Breadth of
Information **Mobility**

CAPEX

TOTEX!

Advanced
Information
Management

Immersing

Simulating

Visualizing

Information Modeling

Analytical Modeling

Design Modeling

Construction Modeling

Asset Performance Modeling

Geo-coordination

Information Mobility

Designing

Constructing

Operating

Immersing

Simulating

Visualizing

Information Modeling

Analytical Modeling

Design Modeling

Construction Modeling

Asset Performance Modeling

Reality Modeling

Information Mobility

Designing

Constructing

Operating

What is Reality Modeling?

Capturing existing conditions in 3D using one or a combination of devices and inputs. (Photos and Point clouds for Hybrid model output)

to support different applications such as

Mapping, Design, Construction, Inspection and Asset Management





Reality Modeling for Mapping



Drawing Helsinki.dgn [3D - V8 DGN] - MicroStation (Technology Preview)

File Home View Annotate Attach Analyze Curves Constraints Utilities Drawing Aids Content

Attributes: None | Default

Primary: Explorer, Attach Tools, Models, Level Display

Selection: Element Selection, Fence Tools

Placement: Line Tools, Arc Tools, Ellipse Tools

Manipulate: Move, Copy, Rotate

Modify: Modify Element, Break Element, Trim Multiple

Groups: Create Region

Search Ribbon (F4)

Properties

Explorer

File

Items

Search

- BuildingFootprints
 - Searches
 - BuildingFootprints Search Results (2)

Resources

Sheet Index

Level Display - View...

View Display

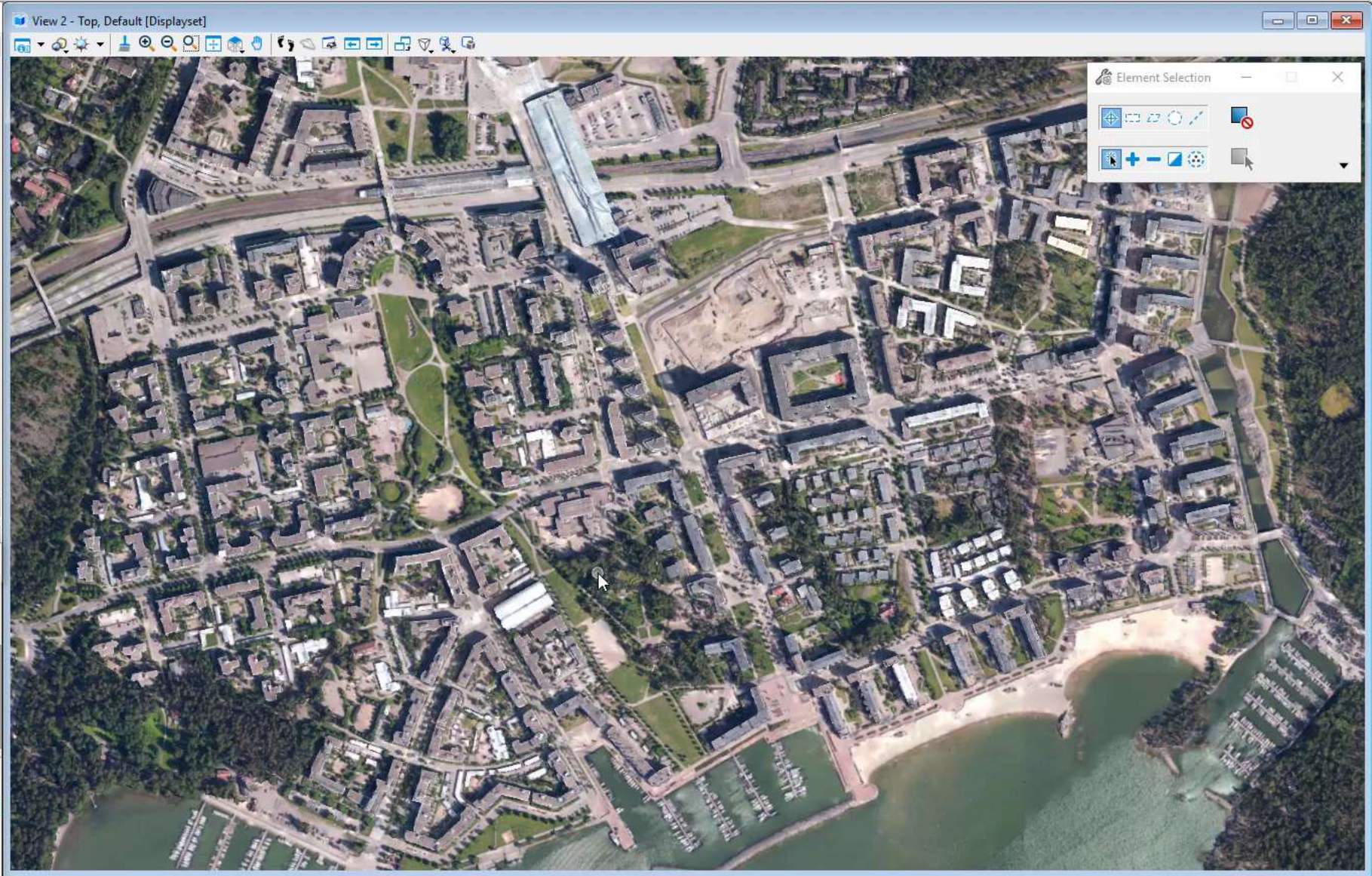
(none) Levels

Helsinki.dgn

- BuildingFootprints.shp

Name	Used
BuildingFootprints	•
Default	

To see properties something must be selected.



Default Views

1 2 3 4 5 6 7 8 X 397335.0081 Y 6675573.1778 Z 566.0700

Element Selection > Identify element to add to set

Default



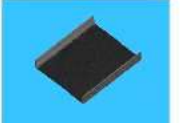
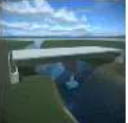
Reality Modeling for Design Workflows





Start Station: 0+030

Bridge Placement

	
Bridge + Barrier (2 lanes)	Cast-In-Place Box Girder
Bridge Template	Superstructure Type
Show Advanced	



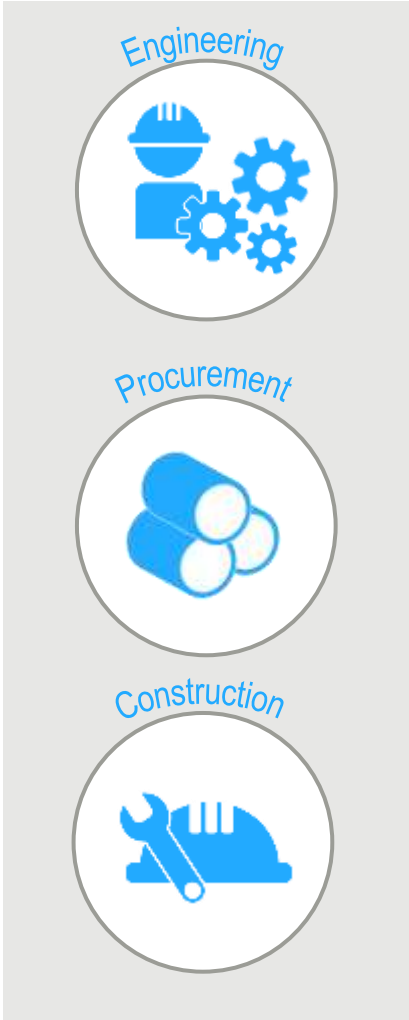


Reality Modeling for Construction Workflows





Collaboration with data & documents



PLUG-IN'S

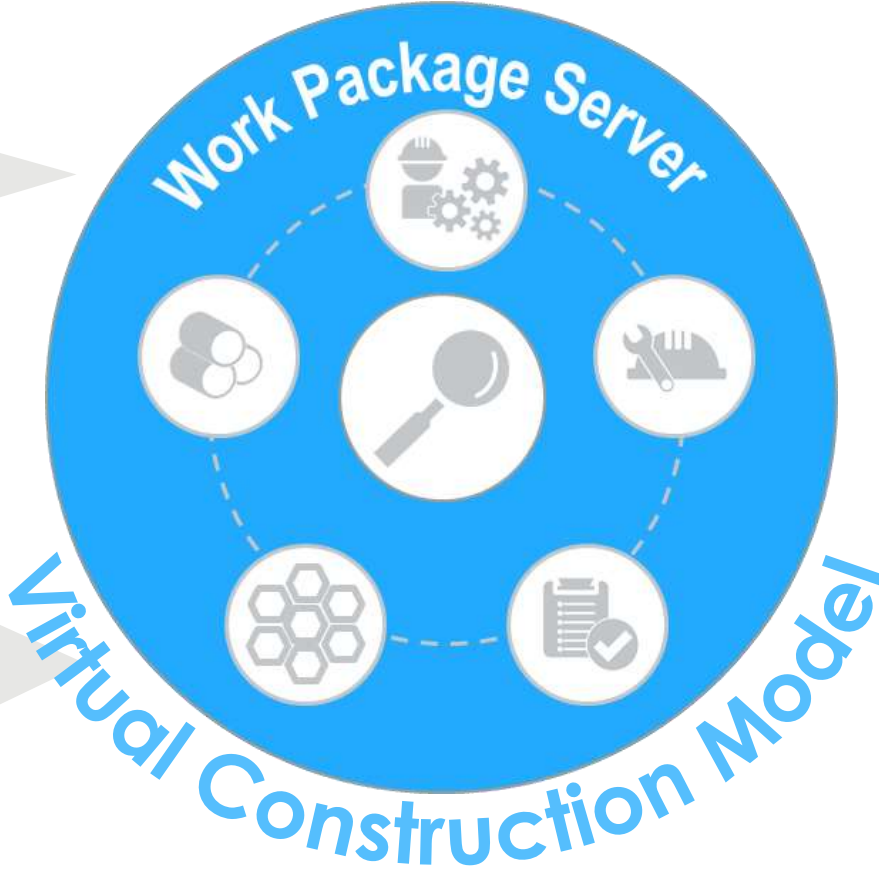


i-model

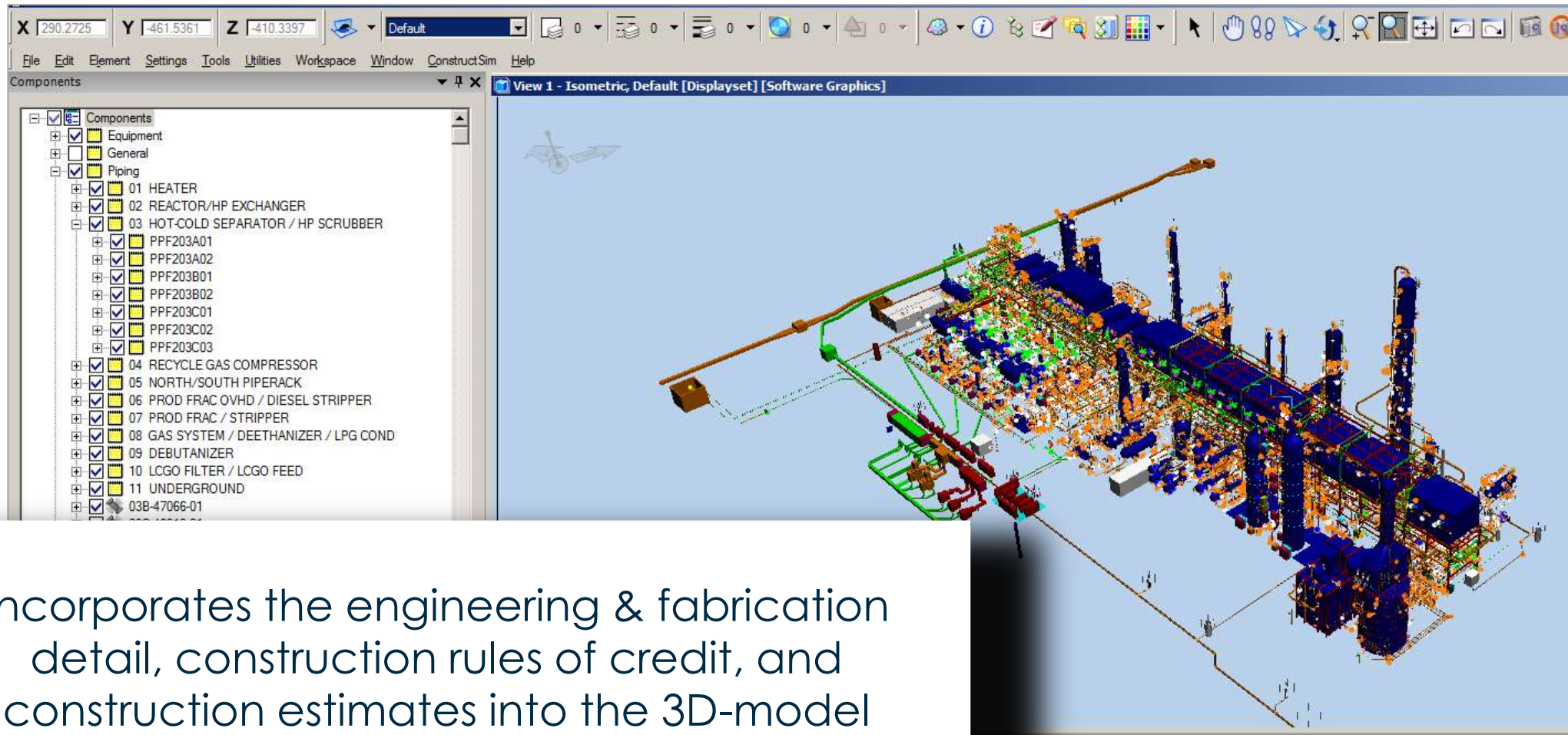
- Scope of work/doc list
- 2D Drawings
- Installation/materials specs
- Vendor data
- Bill of materials
- Equipment/line lists
- Schedule L3
- Fabrication Models
- Fabrication Drawings

TEMPLATES

**EXTRACT
TRANSFORM
LOAD**



ConstructSIM - VCM model view



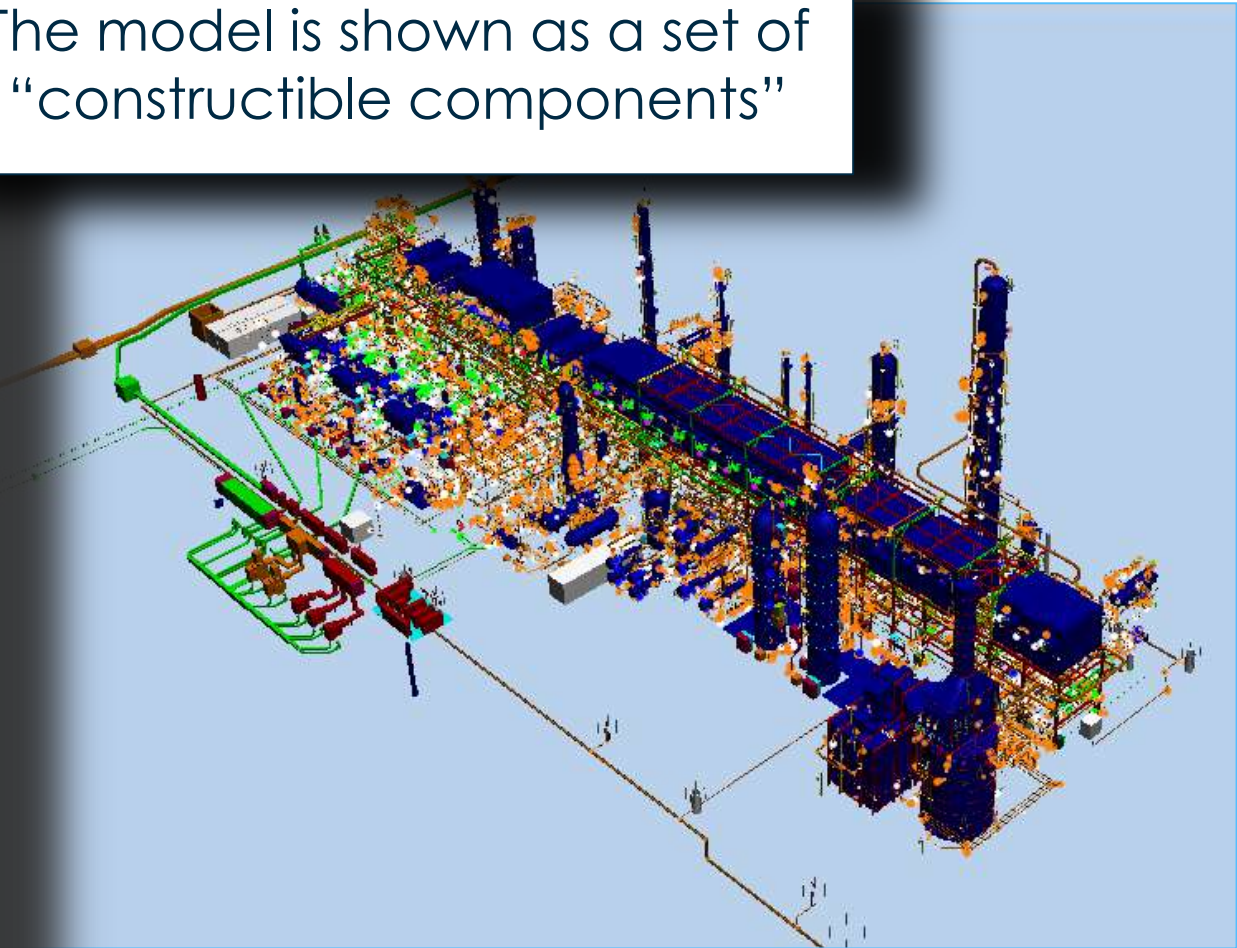
Incorporates the engineering & fabrication detail, construction rules of credit, and construction estimates into the 3D-model

ConstructSIM - VCM model view

The screenshot displays a software interface with a tree view of components. The tree is organized into several main categories:

- Equipment**
 - General
 - Piping
 - 01 HEATER
 - 02 REACTOR/HP EXCHANGER
 - 03 HOT-COLD SEPARATOR / HP SCRUBBER
 - PPF203A01
 - PPF203A02
 - PPF203B01
 - PPF203B02
 - PPF203C01
 - PPF203C02
 - PPF203C03
 - 04 RECYCLE GAS COMPRESSOR
 - 05 NORTH/SOUTH PIPERACK
 - 06 PROD FRAC OVHD / DIESEL STRIPPER
 - 07 PROD FRAC / STRIPPER
 - 08 GAS SYSTEM / DEETHANIZER / LPG COND
 - 09 DEBUTANIZER
 - 10 LCGO FILTER / LCGO FEED
 - 11 UNDERGROUND
 - 03B-47066-01
 - 03C-46313-01
 - 09A-45838-05
- Structural
 - BGRSteel01
 - Assembly - 244
 - Assembly - 309
 - Assembly - 365
 - Assembly B-1 - 1
 - Assembly B-1 - 10
 - Assembly B-1 - 100

The model is shown as a set of “constructible components”

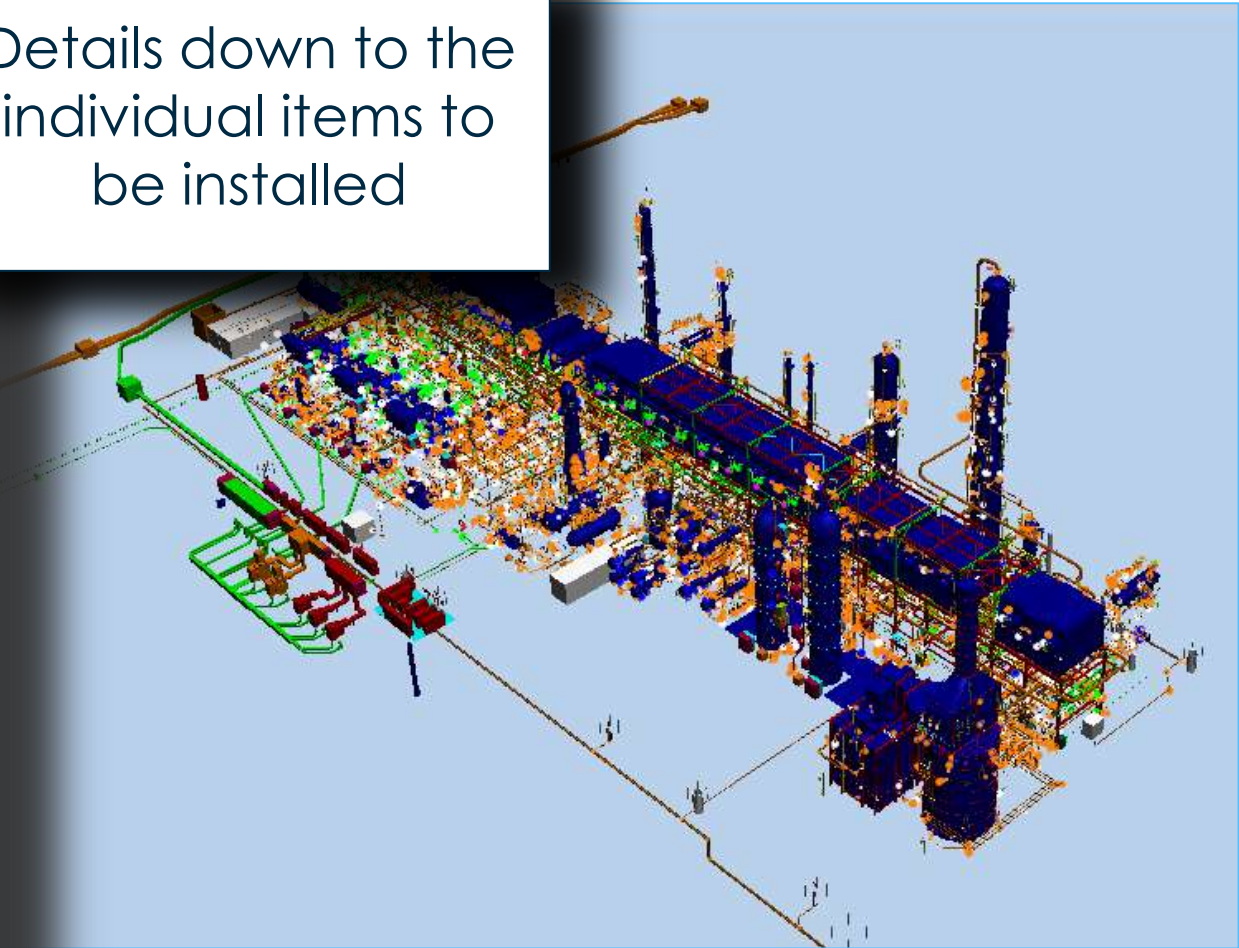


ConstructSIM - VCM model view

The screenshot shows a software interface with a tree view of components. The tree is organized as follows:

- Components
 - Equipment
 - General
 - Piping
 - 01 HEATER
 - 02 REACTOR/HP EXCHANGER
 - 03 HOT-COLD SEPARATOR / HP SCRUBBER
 - PPF203A01
 - 03A-45381-01
 - BOLTUP-01 (03A-45381-01)
 - BOLT CB7018
 - GASKET RGA53-7
 - MC-01DT2739 (03A-45381-01)
 - 03A-45381-02
 - 03A-45382-01
 - 03A-45382-02
 - 03A-45382-03
 - 03A-45382-04
 - 03A-45382-05
 - 03A-45382-06
 - 03A-45383-01
 - 03A-45384-01
 - 03A-45384-02
 - 03A-45384-03
 - 03A-45384-04
 - 03A-45384-05
 - 03A-45384-06
 - 03A-45385-01
 - 03A-45385-02
 - 03A-45385-03
 - 03A-45387-01
 - 03A-45387-02
 - 03A-45387-03

Details down to the individual items to be installed





Reality Modeling for Asset Management



Reality Modeling for Asset Performance Management



Facility Optimization Including Energy Management

Global
Danfoss



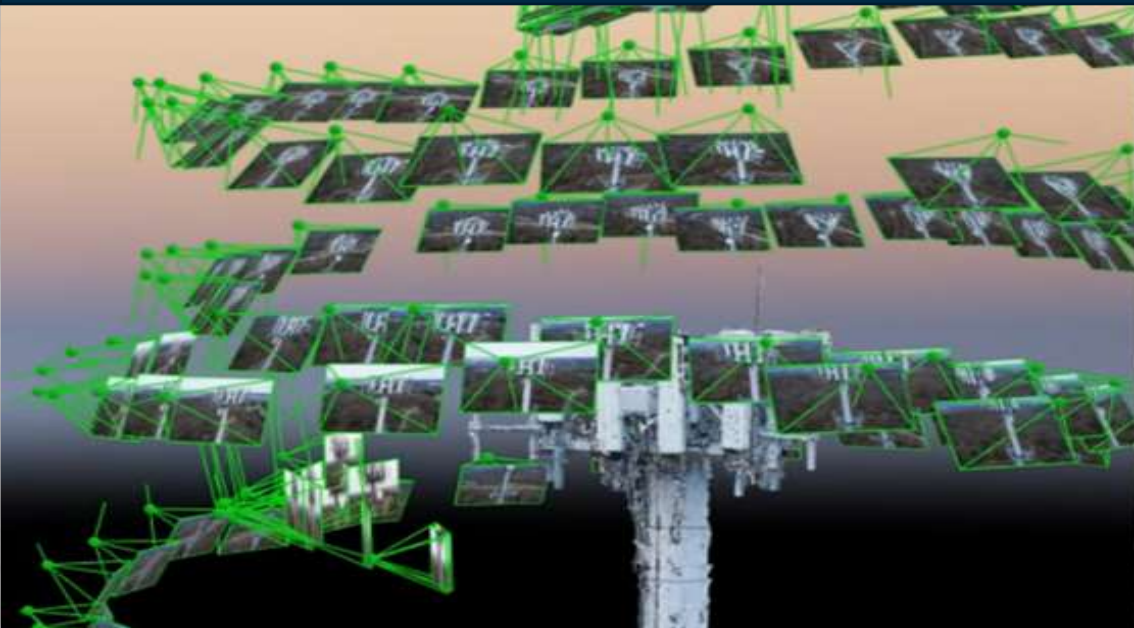
Project Playlist

- Amulet

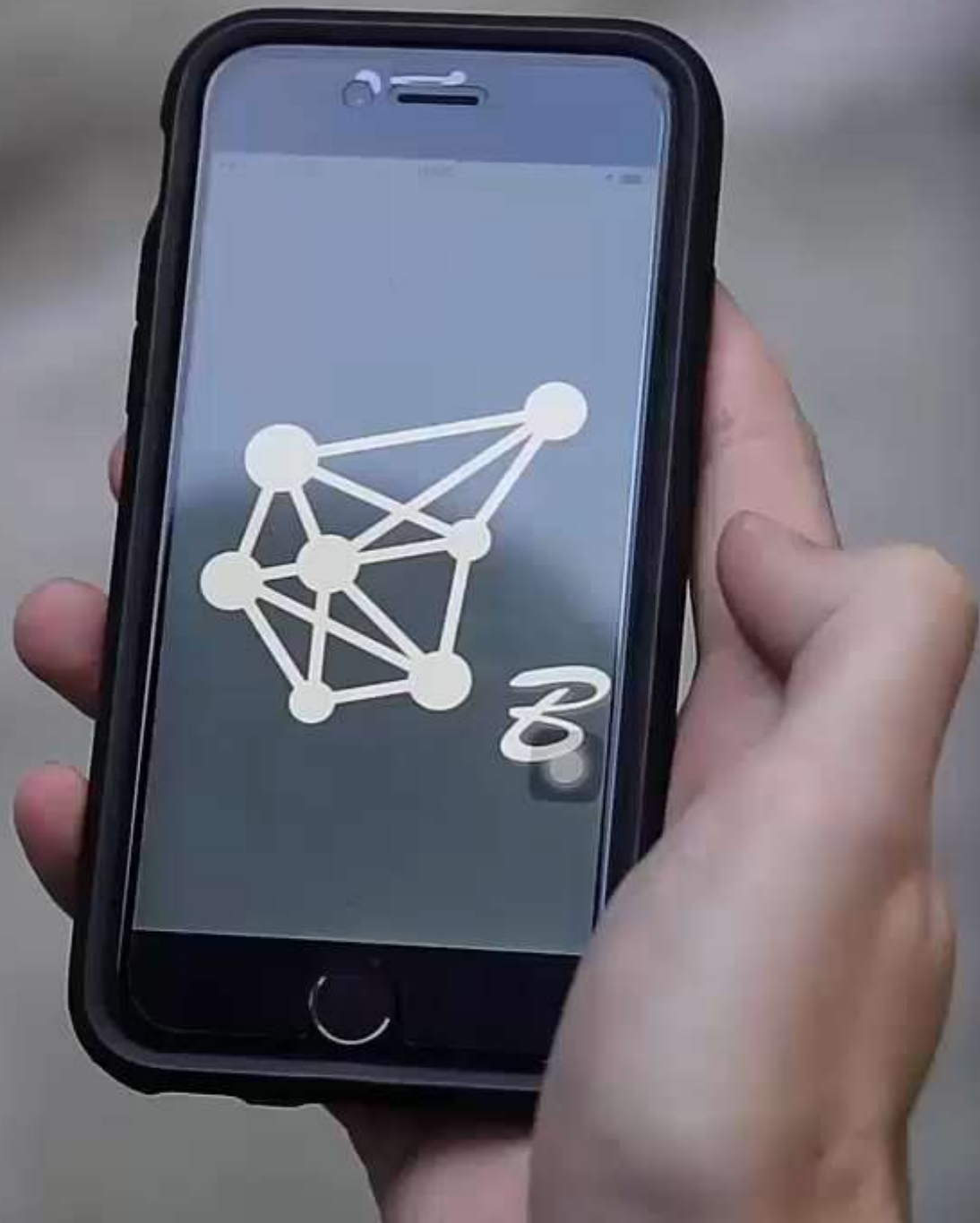
2016 *Be Inspired* Finalist
Innovation in Asset Performance



Reality Modeling for Inspection Workflows

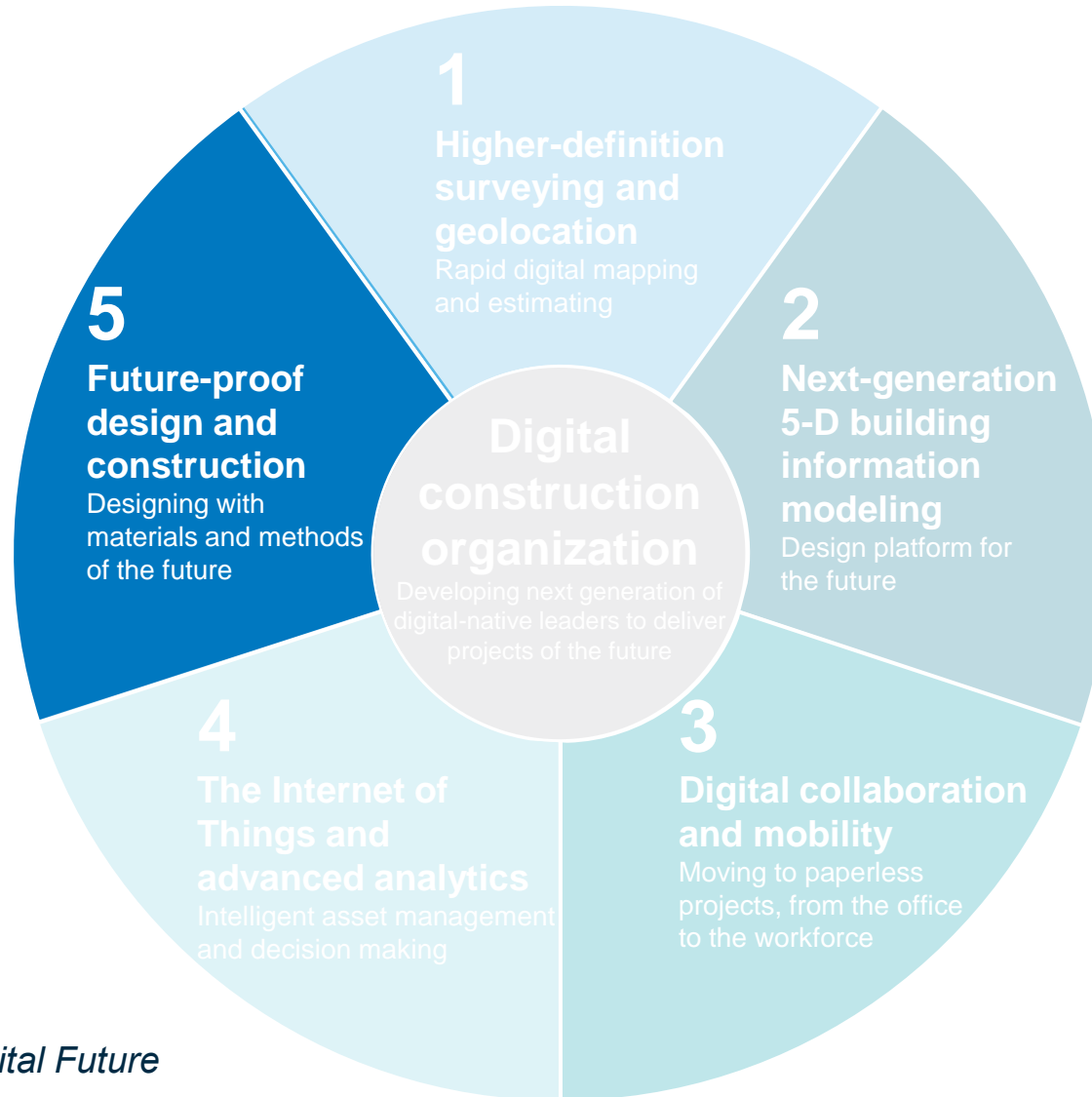








Going Digital...



Source: *Imagining Construction's Digital Future*
McKinsey, June, 2016

Information Mobility for the Crossrail Smart Railway
London
Crossrail

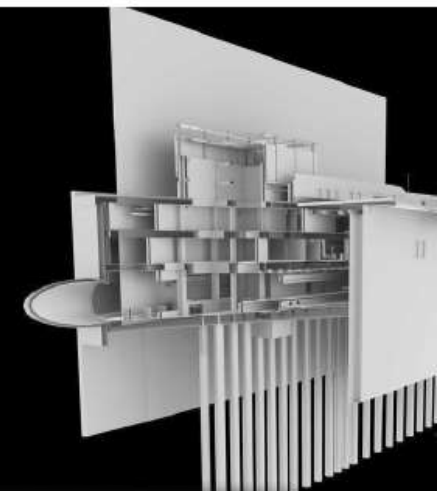


Virtual & Physical

We're Building Two Crossrail's..



- ▶ Physical
- ▶ Virtual



Project Playlist

- AssetWise
- ProjectWise

2013 *Be Inspired* Finalist
Innovation in Asset Performance



SAVE THE DATE

THE **YEAR IN INFRASTRUCTURE 2017** CONFERENCE

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

Visit us at our Booth at the Exhibition Hall in
Geosmart Asia 2017 for more details

m.rajathurai@bentley.com

WWW.BENTLEY.COM/YII2017