Bentley
Sustaining Infrastructure

From BIM to ALIM

Generating value by connecting (building) information models with asset lifecycle and performance management

Lutz Bettels, Industry Sales Director Building CEE, Bentley Systems

Agenda

- Setting the stage
- BIM authoring for owner/operators
- Aggregating and transforming BIM information for construction and operation
- Maintaining the BIM model through construction
- Connecting the as-built BIM model with operational systems
- Leveraging an up to date IM to optimize asset performance

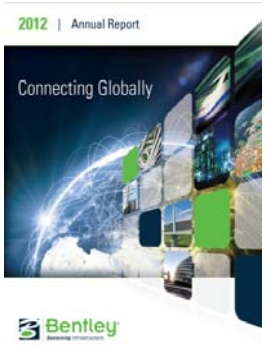
About Bentley

Bentley®

Sustaining Infrastructure

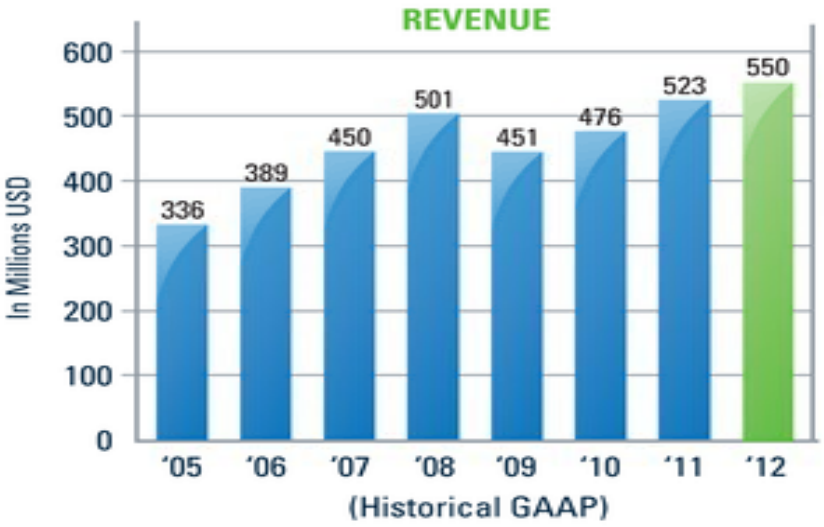
Bentley's mission is to provide innovative software and services for the enterprises and professionals who design, build and operate the world's infrastructure - sustaining the global economy and environment, for improved quality of life.

2012 Annual Report



View or download at:

www.bentley.com/annualreport



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- Bridges
- Roads
- Rail and Transit Networks
- Power Plants
- Water and Wastewater Utilities
- Construction Simulation
- Collaboration Services
- Process Plant Operations
- Structural Analysis
- 3D City Modeling

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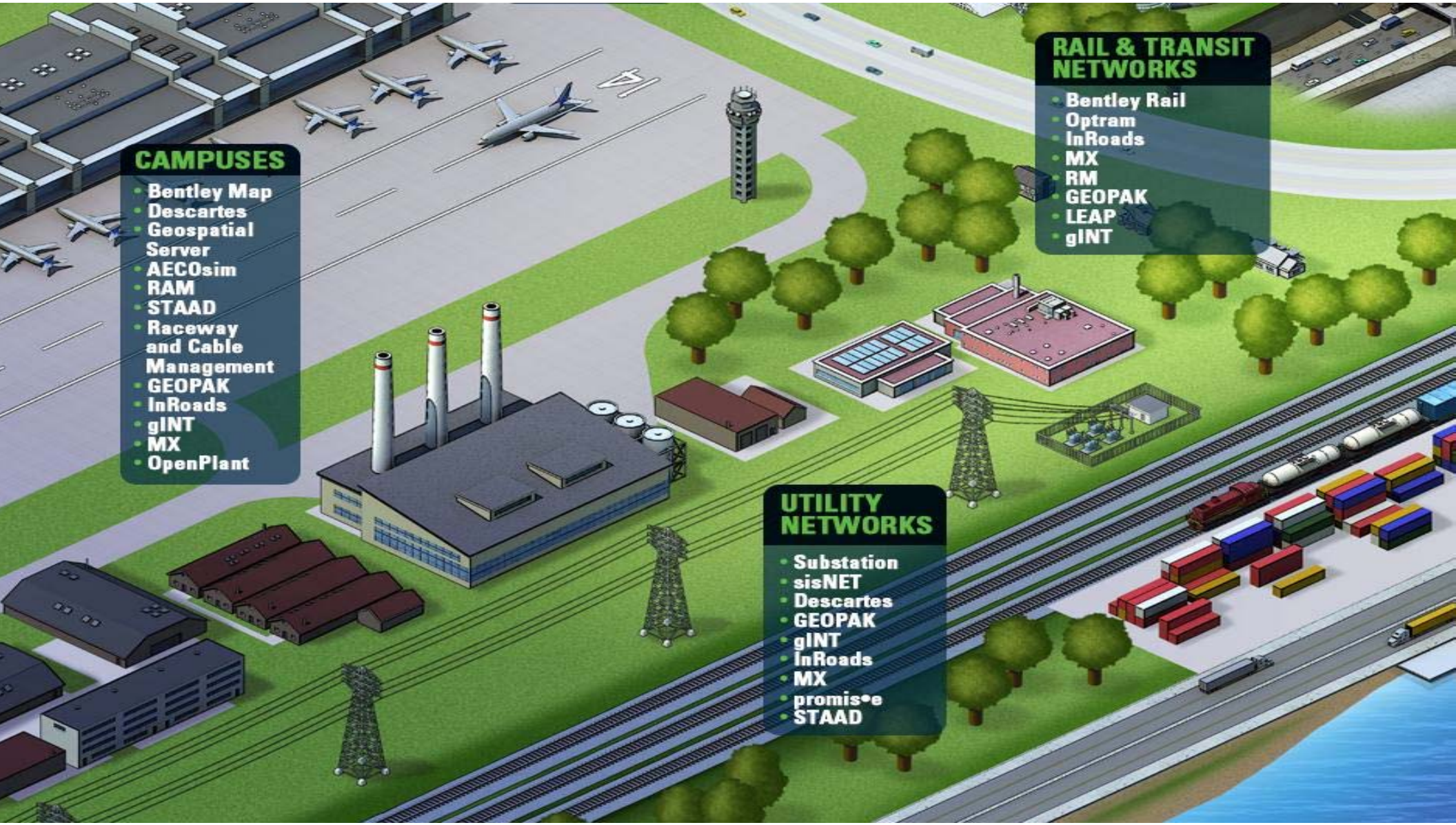
CAMPUSES
Bentley Map
Descartes
Geospatial Server
AECOsim
RAM
STAAD
Raceway and Cable Management
GEOPAK
InRoads
gINT
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OpenPlant
RAIL & TRANSIT NETWORKS
Bentley Rail
Optram
InRoads
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GEOPAK
LEAP
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STAAD

London 2012

Sustaining the Infrastructure of *'London 2012'*

Leading AECO organizations, empowered by Bentley Systems software and services, have been instrumental in shaping and sustaining London's infrastructure for close to 30 years. Among their contributions shown here are significant structures within London's skyline and the facilities and transportation systems that helped make the London Olympics such a big success.

London exemplifies the United Kingdom's steadfast commitment to infrastructure development as a key driver of long-term economic growth. And its leadership in the adoption of innovations such as *BS 1192* for managing construction information to help achieve fully collaborative *Building Information Modeling* by 2016, *generative design*, and *intelligent asset management* underpins that strategy. Bentley and AECO organizations working in London and across the U.K. will continue to further advance the use of these innovations in the development of intelligent infrastructure for improved quality of life while increasing the competitiveness of "U.K. PLC" worldwide.

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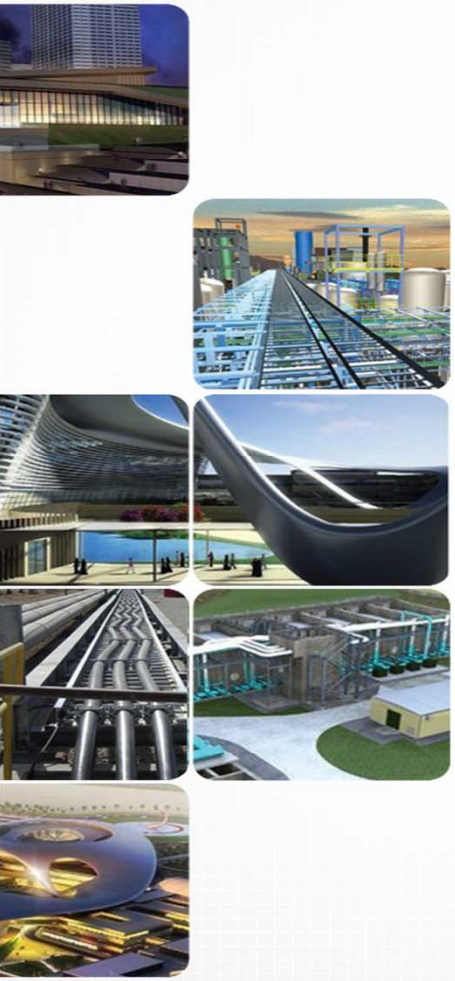

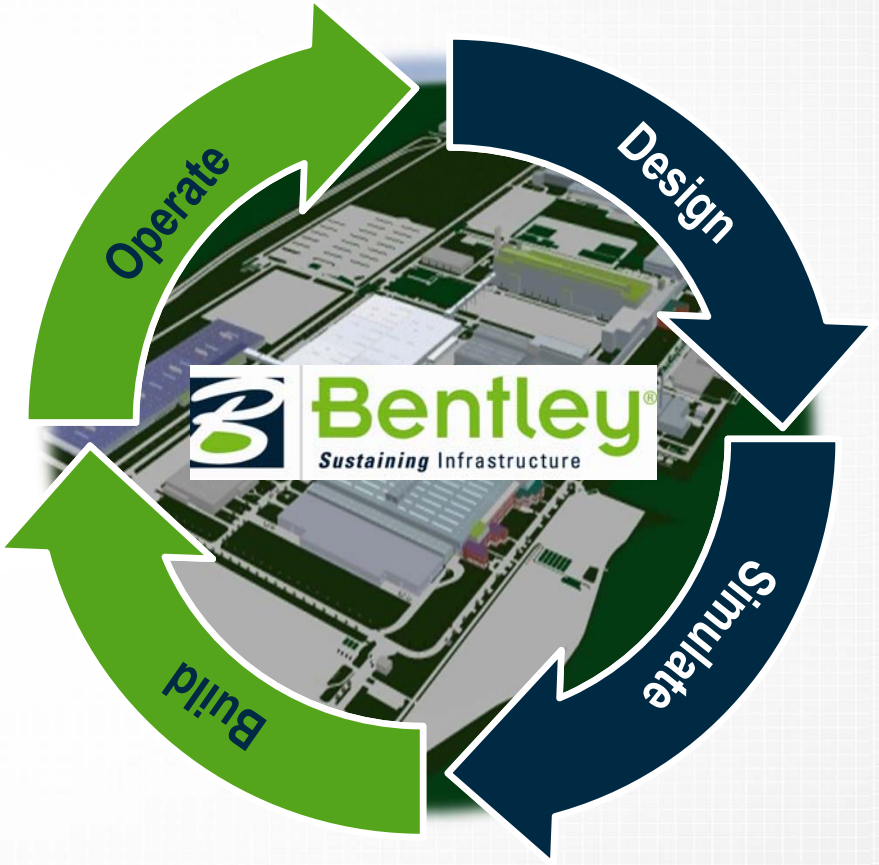

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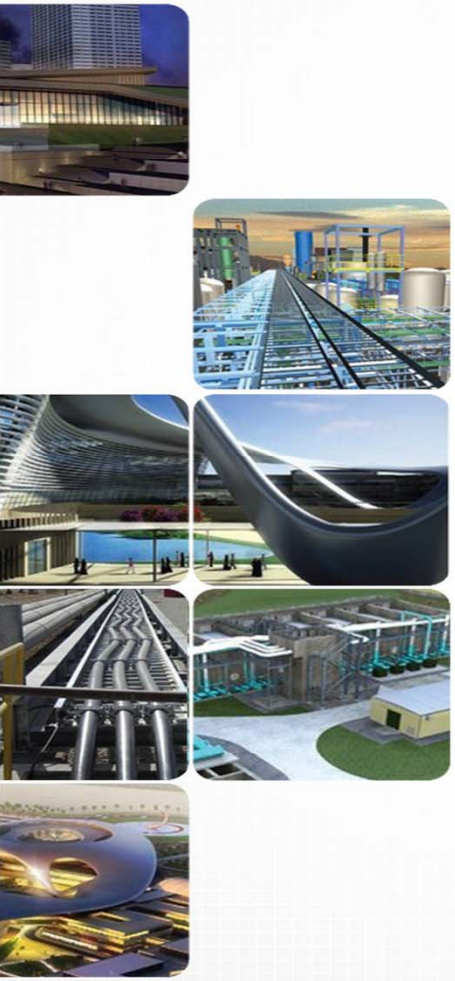

BIM authoring for owner/operators

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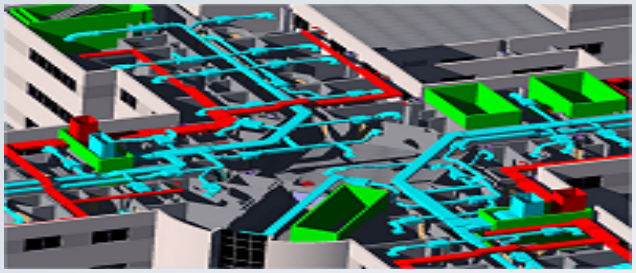
BIM Authoring Tools

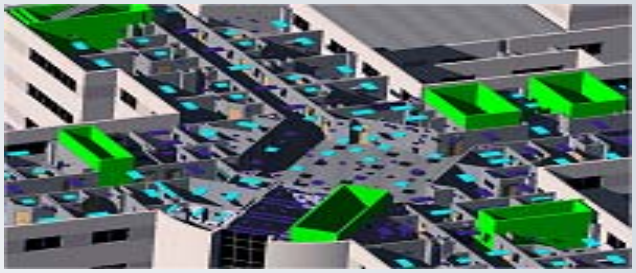
Deliver High Performance Buildings through interdisciplinary building design, analysis, simulation and the production of high quality building and project documentation.

AECOsim Building Designer

Interdisciplinary Building Information Modeling

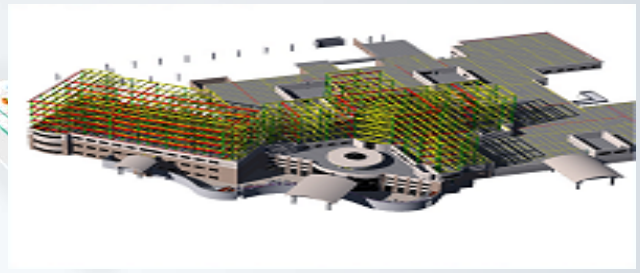


Mechanical/Plumbing



Electrical

Architectural



Structural

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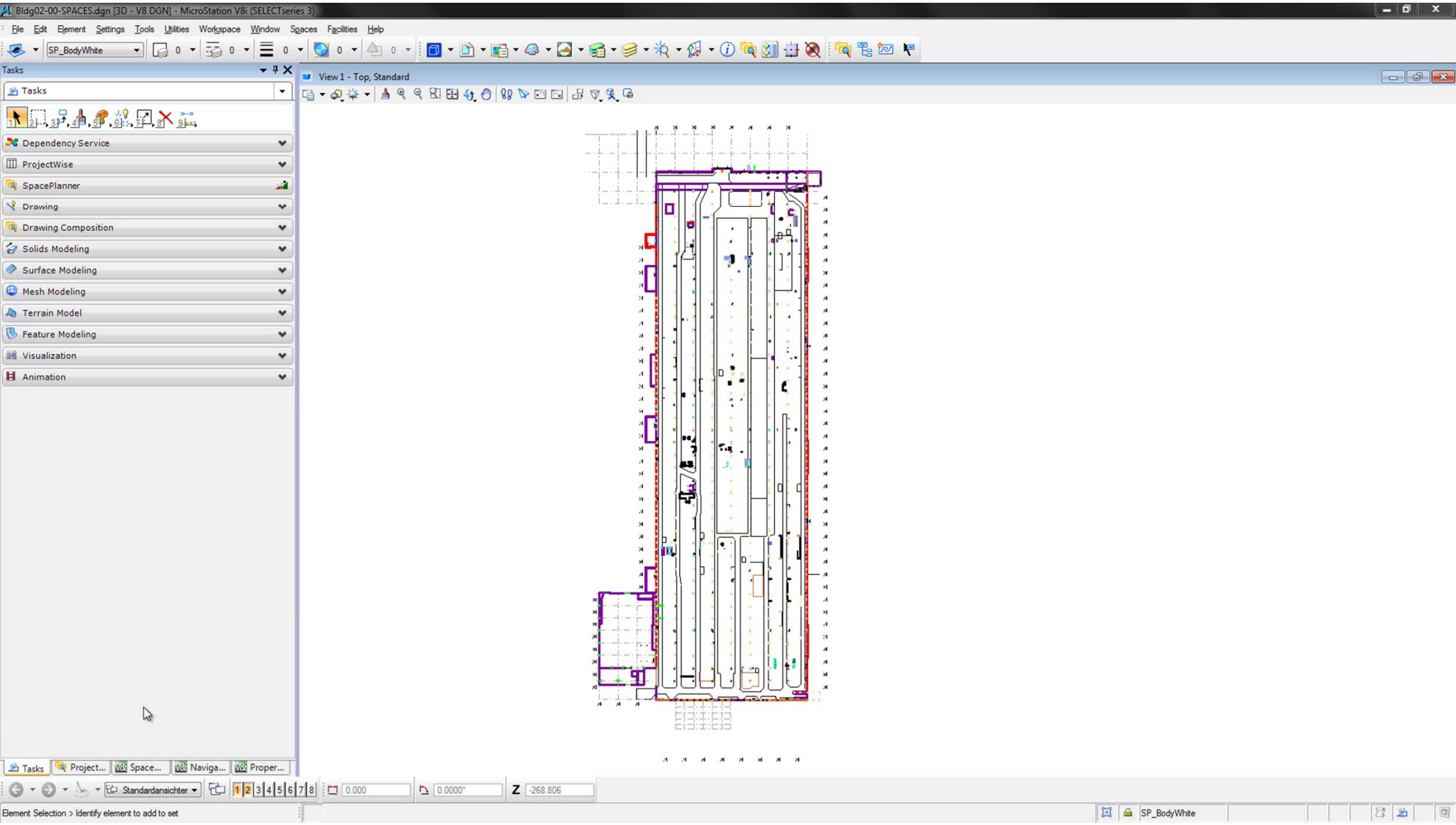
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Tasks
Tasks
Dependency Service
ProjectWise
SpacePlanner
Drawing
Drawing Composition
Solids Modeling
Surface Modeling
Mesh Modeling
Terrain Model
Feature Modeling
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Animation
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SP_BodyWhite

Hybrid Planning 3D models in Point Clouds

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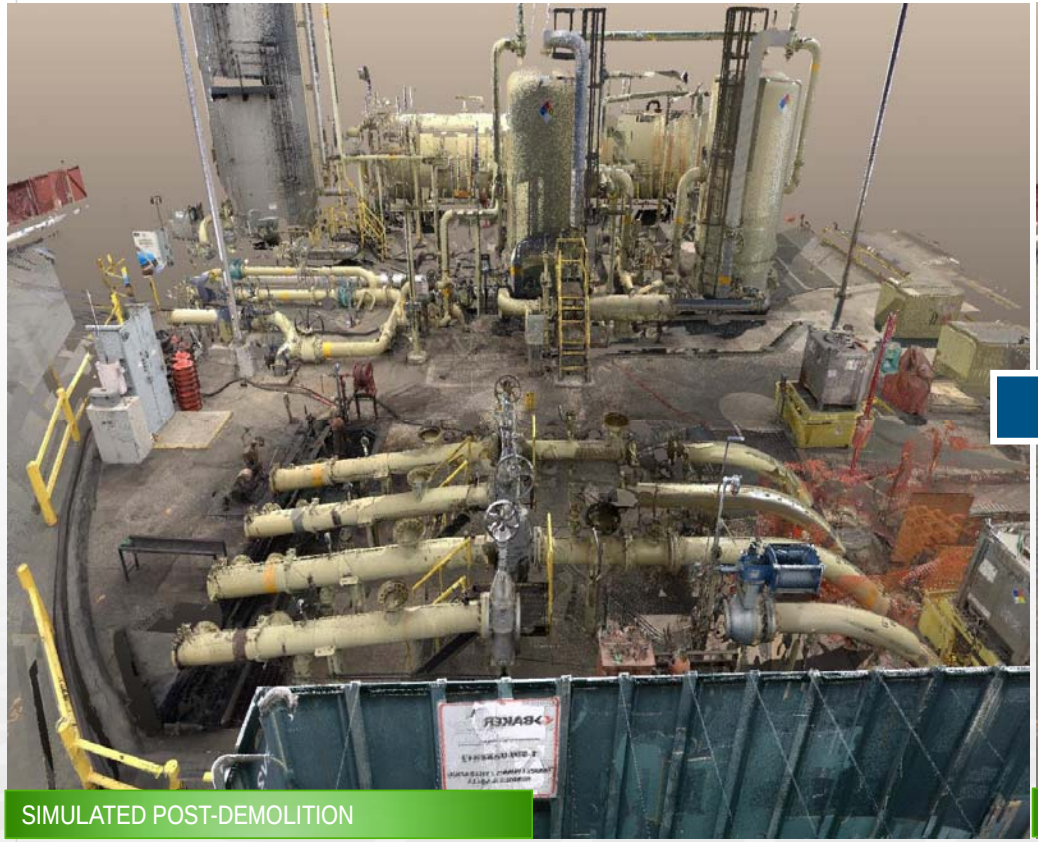
Hybrid Planning 3D models in Point Clouds



SIMULATED POST-DEMOLITION

DESIGN MODEL MOCK-UP

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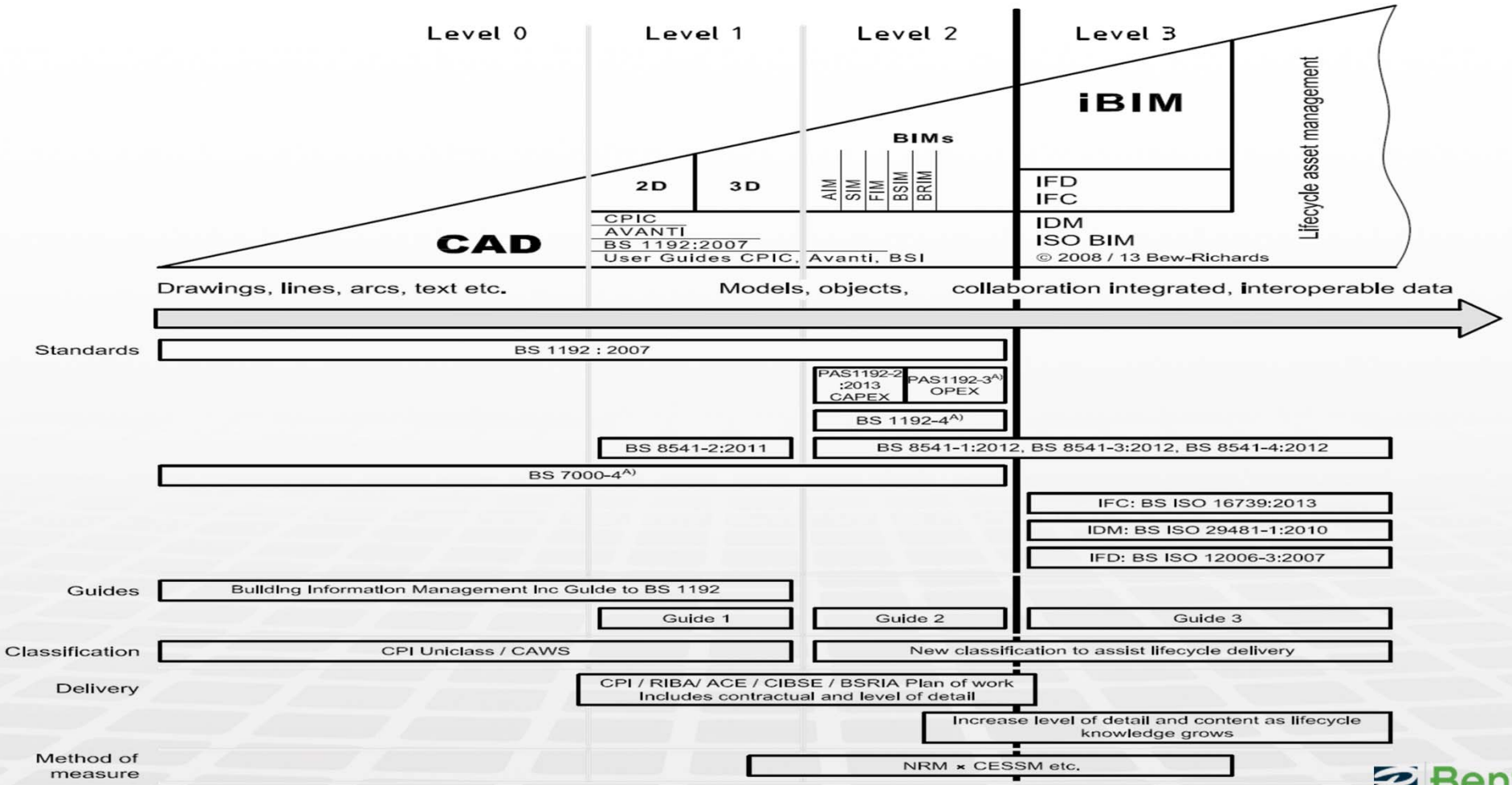
British BIM Standard BS1192



Quelle: B555_Roadmap_JUNE_2013

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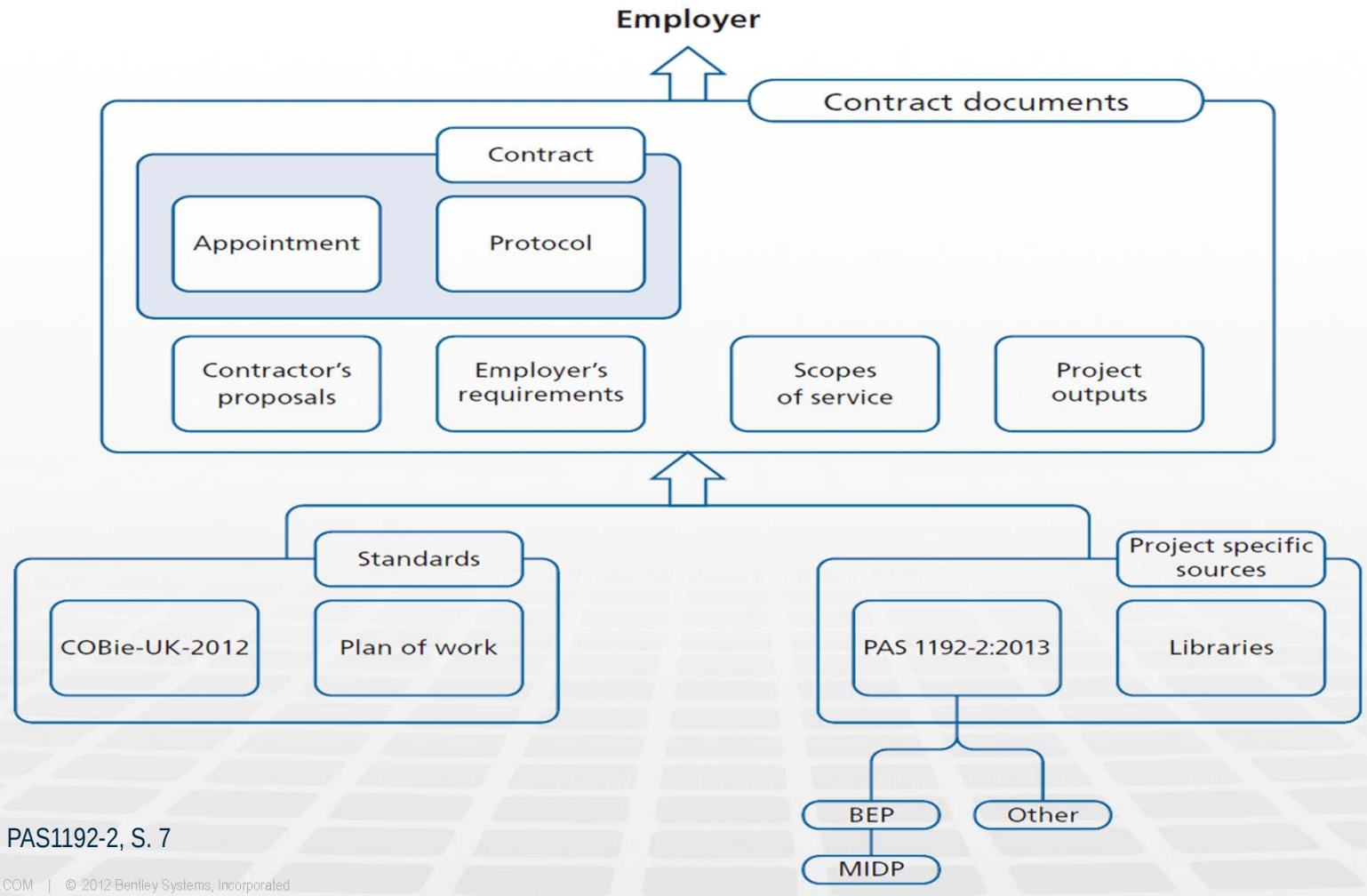
British BIM Standard BS1192



Quelle: PAS1192-2, S. 7

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(B)IM Standards of Owner/Operators

- Auch Industrieunter-nehmen haben ihre (B)IM Standards definiert
- Schreiben diese ihren Planern und Lieferanten verbindlich vor

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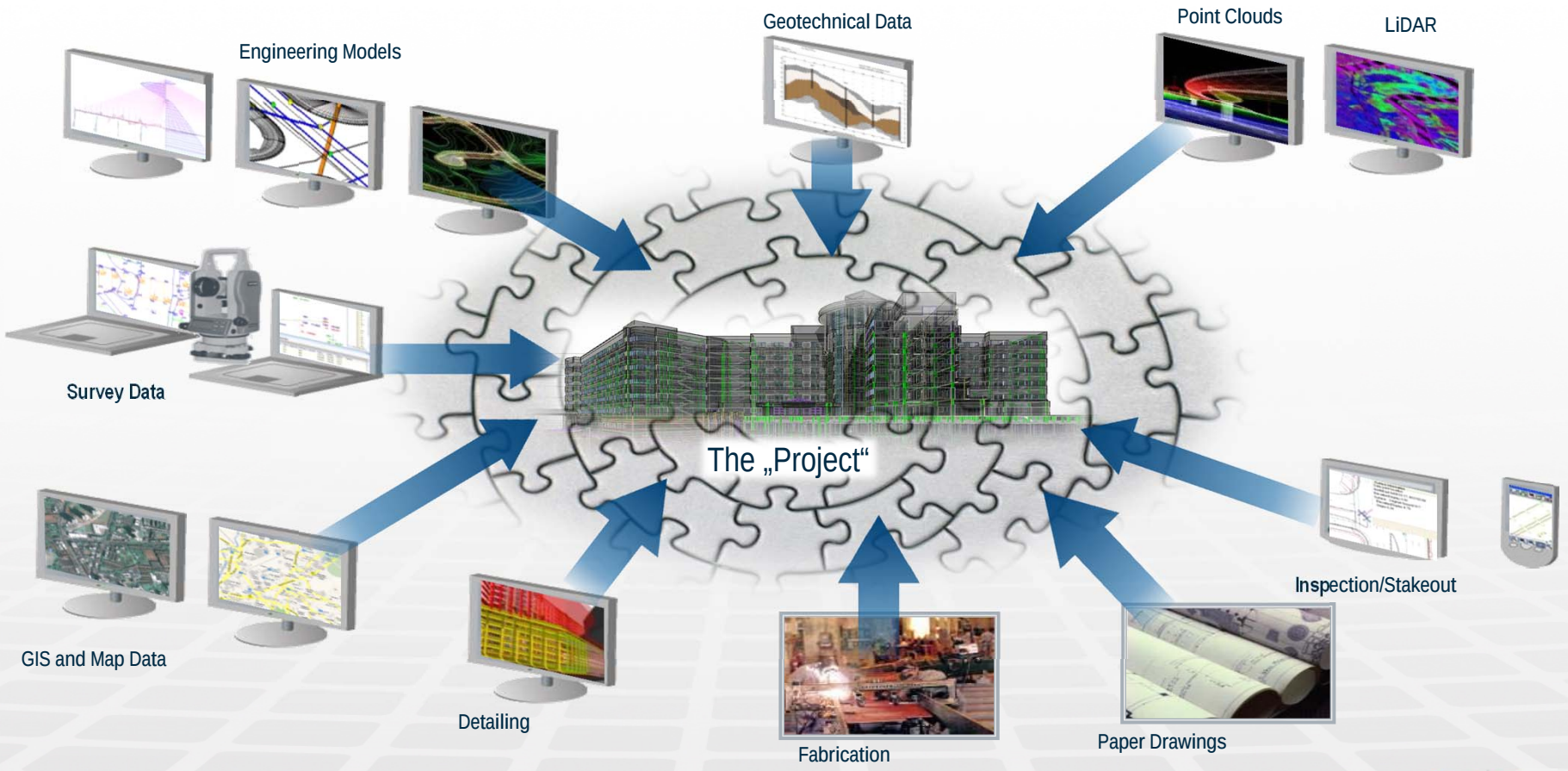
Multi-source Project Integration



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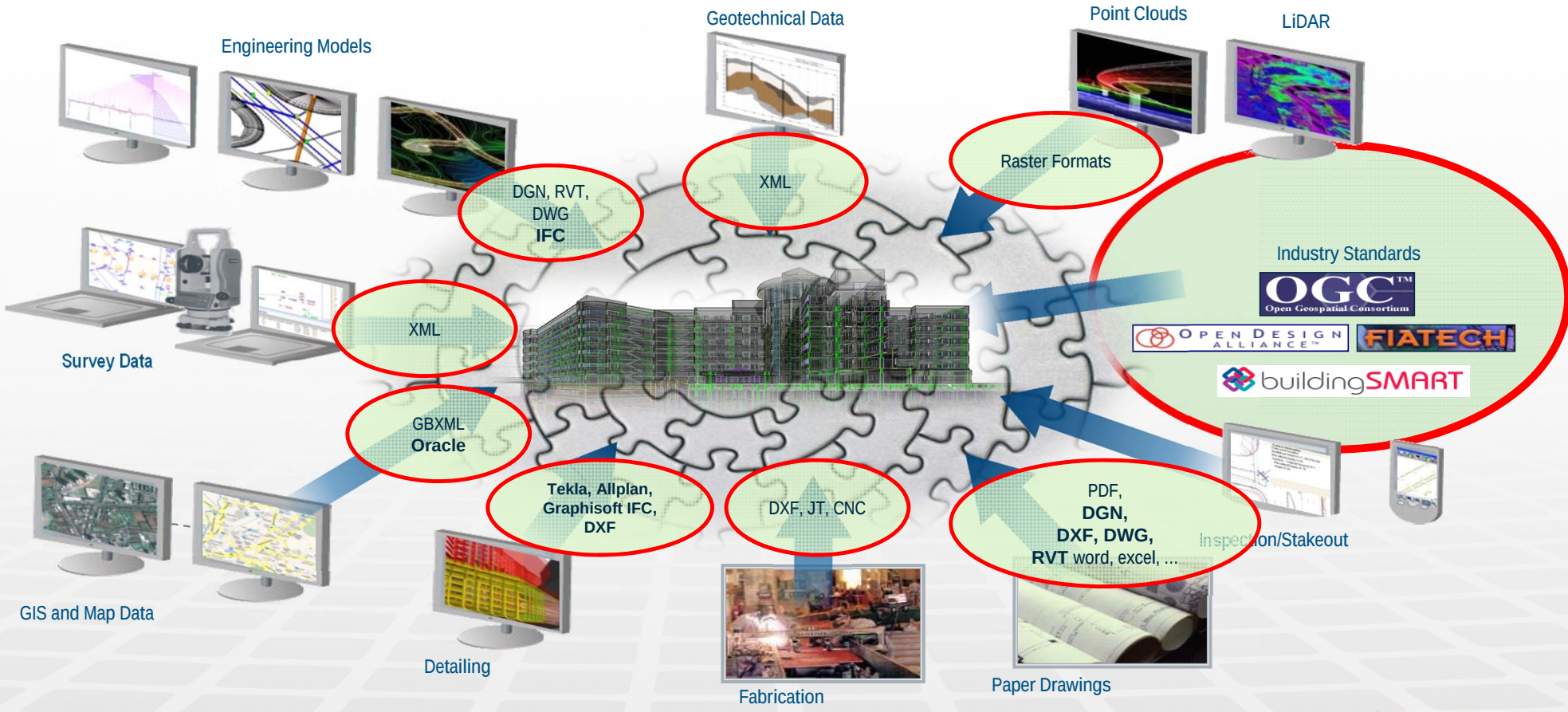
Multi-source Project Integration



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- Central managed environment for trusted sharing and collaboration

The federated information

Model gets created in the

Collaboration environment

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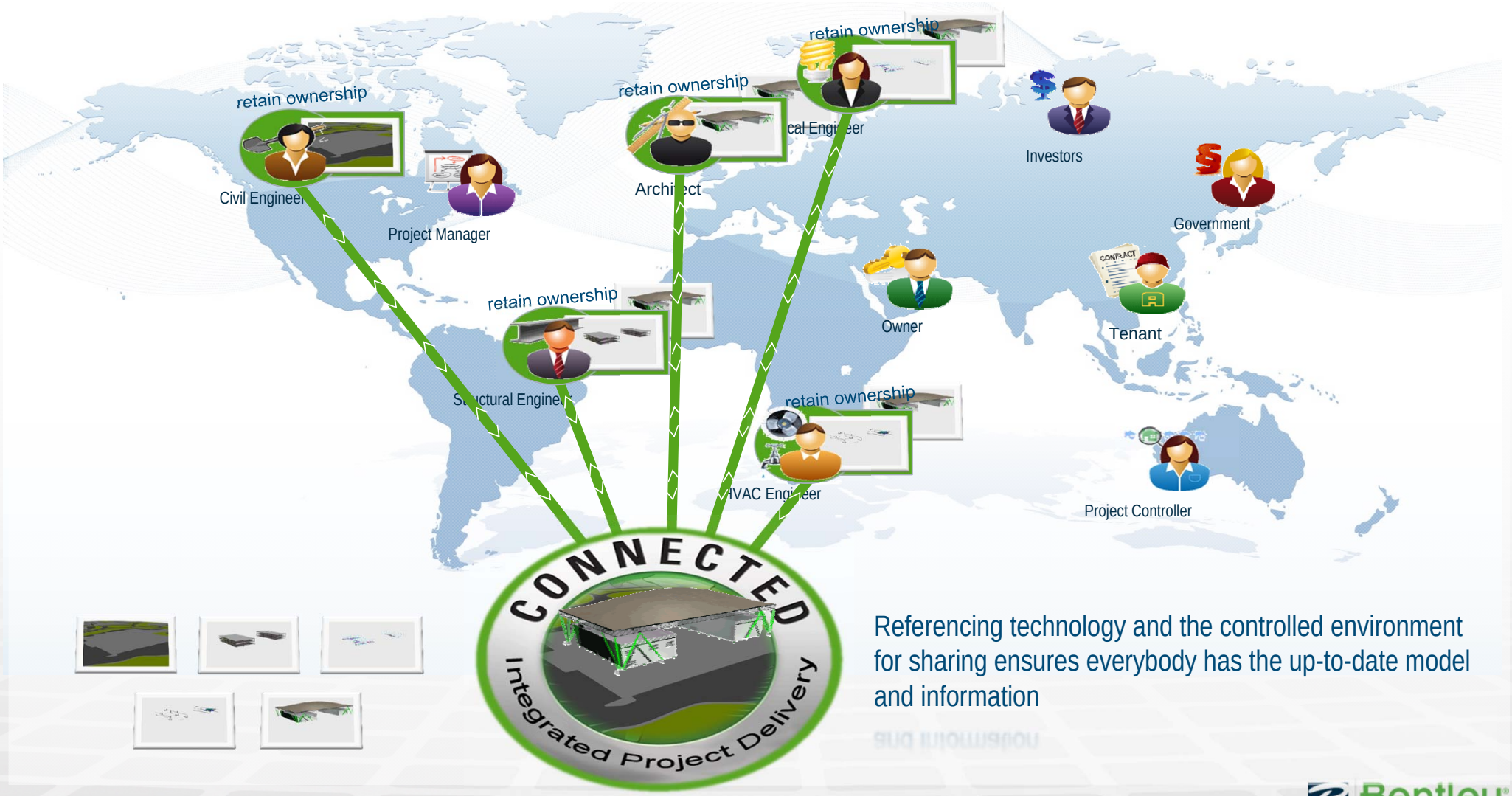

Referencing technology and the controlled environment for sharing ensures everybody has the up-to-date model and information

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ProjectWise Core Capabilities

- Core capabilities enable project teams to…
  - Connect easily with project information for collaboration
  - Federate management, publishing, and review services
  - Optimize information access to accelerate workflow

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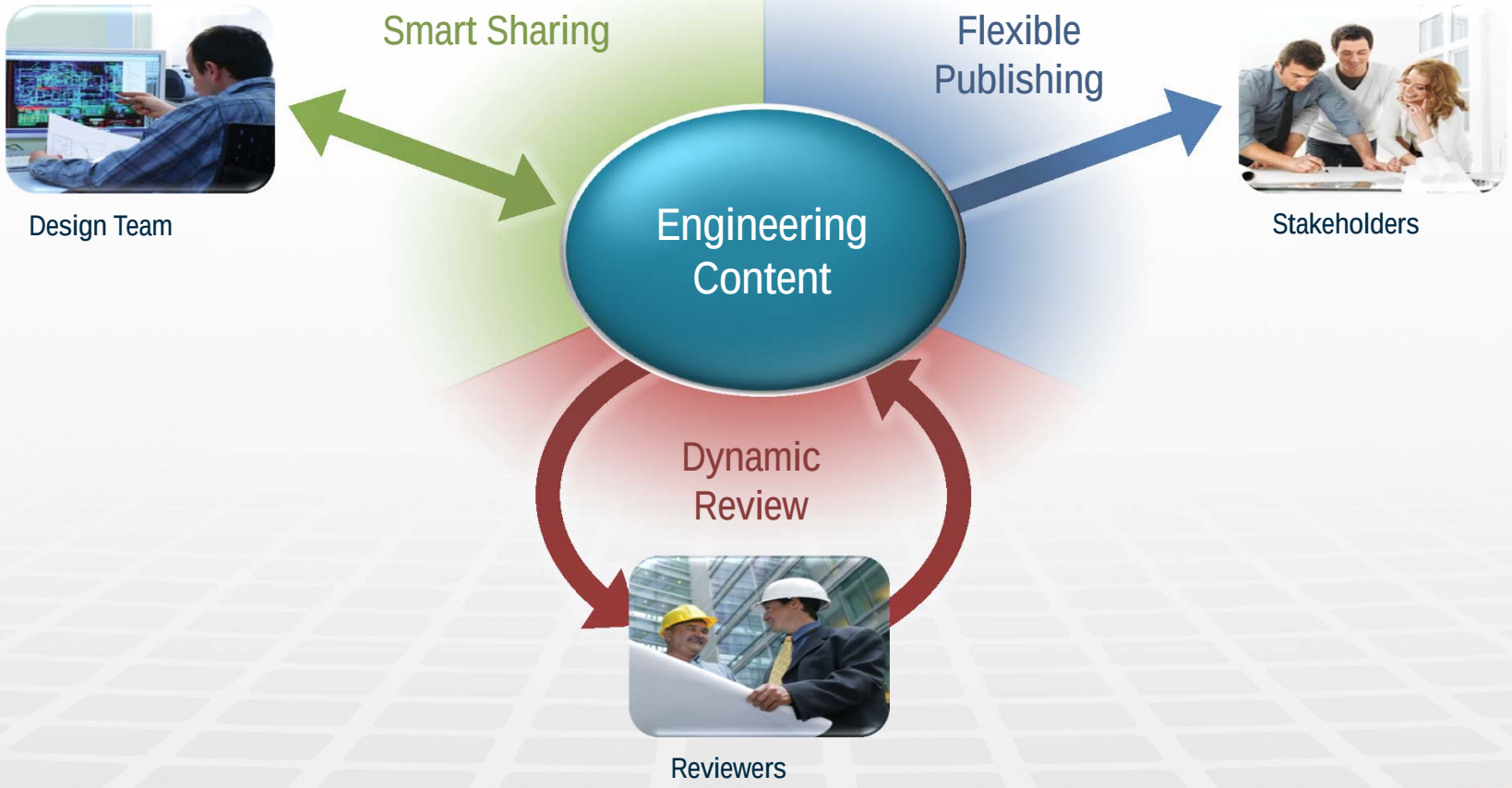
Sharing, Review & Publishing for Infrastructure



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Smart Sharing

- Cooperate through a single source of truth for distributed projects

…where the right people quickly and reliably accelerate work-in-progress using infrastructure tools and workflows of choice.

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Smart Sharing

- Work in an infrastructure-specific project environment:

MicroStation V8*i*

RAM Structural System V8*i*

OpenPlant

Office

AutoCAD

Revit

esri

Engineering Content

- Projects of all sizes
- Inter-related, federated data
- Common infrastructure tools in defined workflows

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Flexible Publishing

- Inform project stakeholders

…in a more consistent, timely and predictable manner using high impact deliverables.

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Flexible Publishing

- Produce standards-based documents

- Automated or on demand
- User-defined standards
- All media types
- All device types

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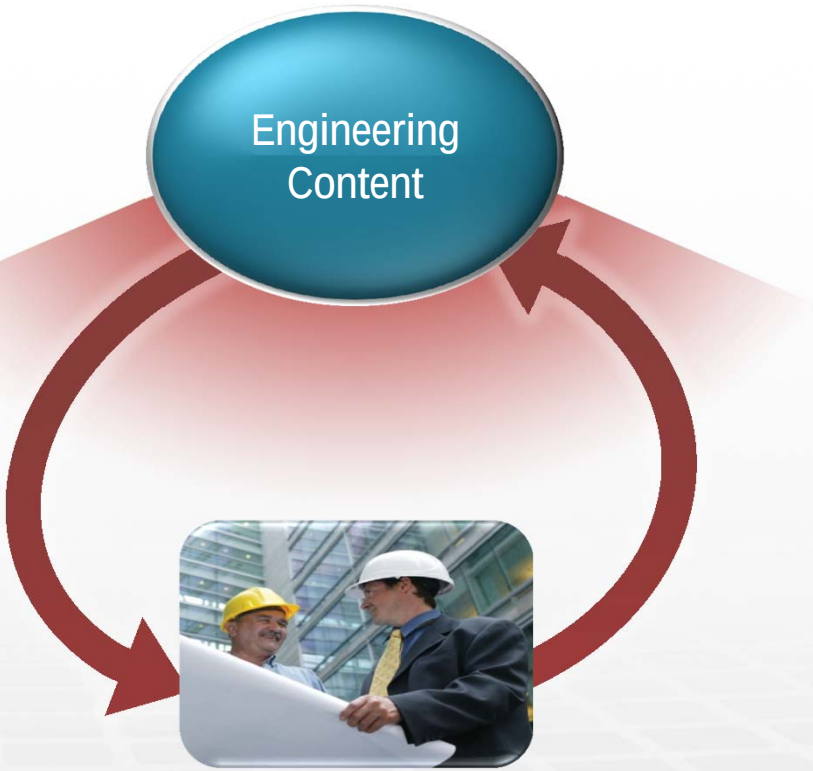
Dynamic Review

Synchronize comments
to resolve issues
quickly and effectively

…in a ‘closed-loop’, returning feedback in context to all the relevant designers so as to be actionable.



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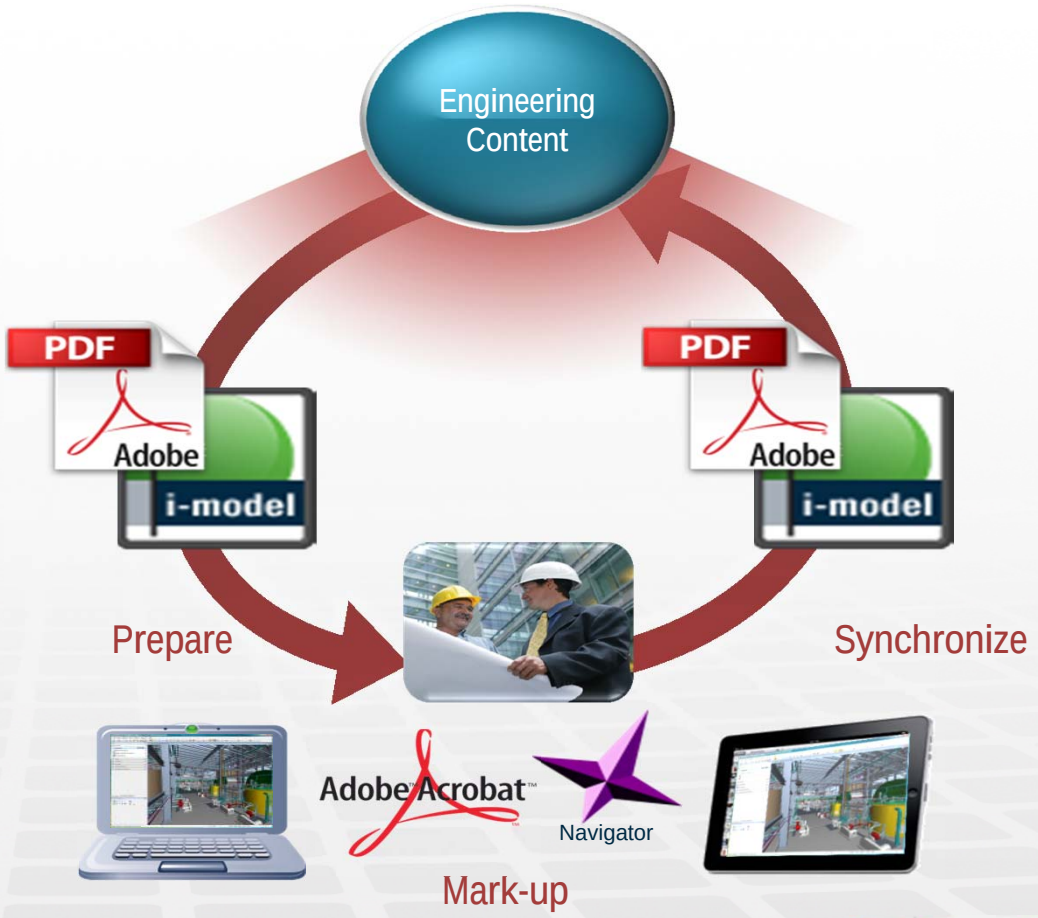
Dynamic Review

- Synchronize Mark-ups with Bentley Navigator or Acrobat

- Feedback captured anywhere
- Computer or iPad
- PDF or Model-based
- Audit trail



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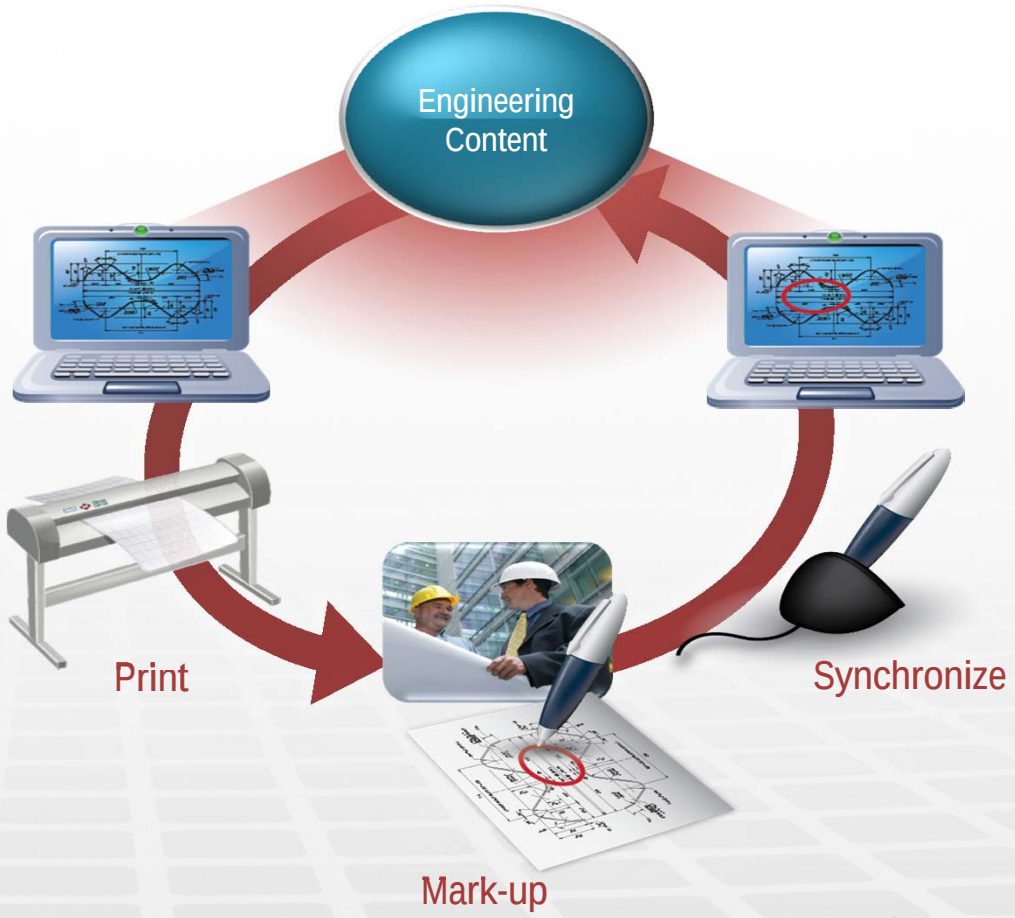
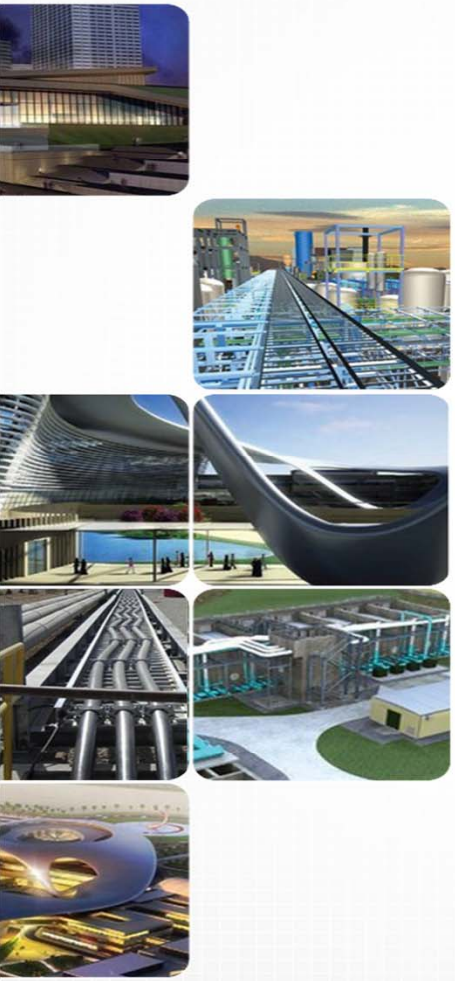
Dynamic Review

Synchronize Mark-ups With Pen and Paper

- Dynamic Plots
- Smart Pens
- Traditional workflow
- “Redlines”



Bentley Sustaining Infrastructure



Aggregating and Transforming BIM Information for Construction and Operation

i-model - Currency for Information Exchange

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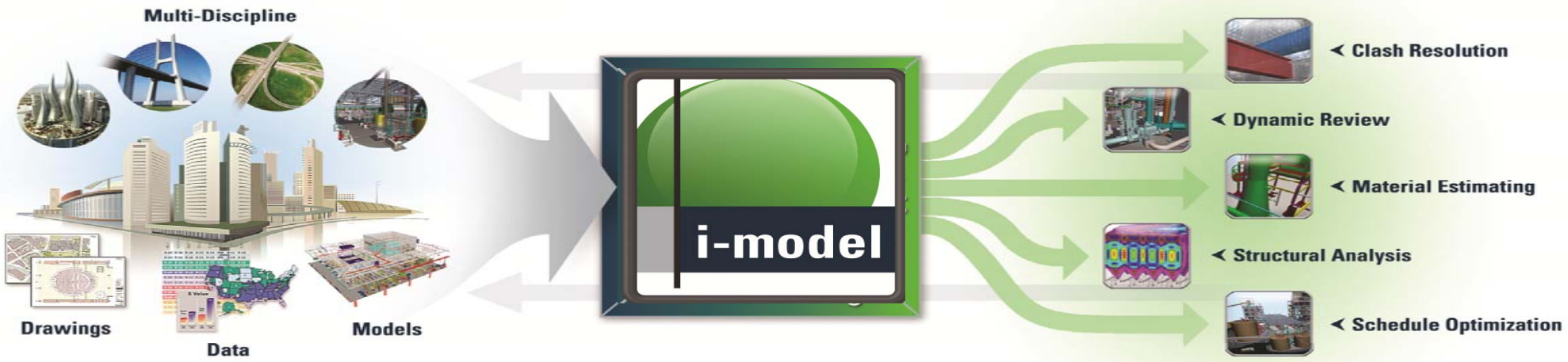
i-models: Containers for Information Exchange

A key differentiating technology from Bentley



Portable - Self-Describing - Secure - Provenance

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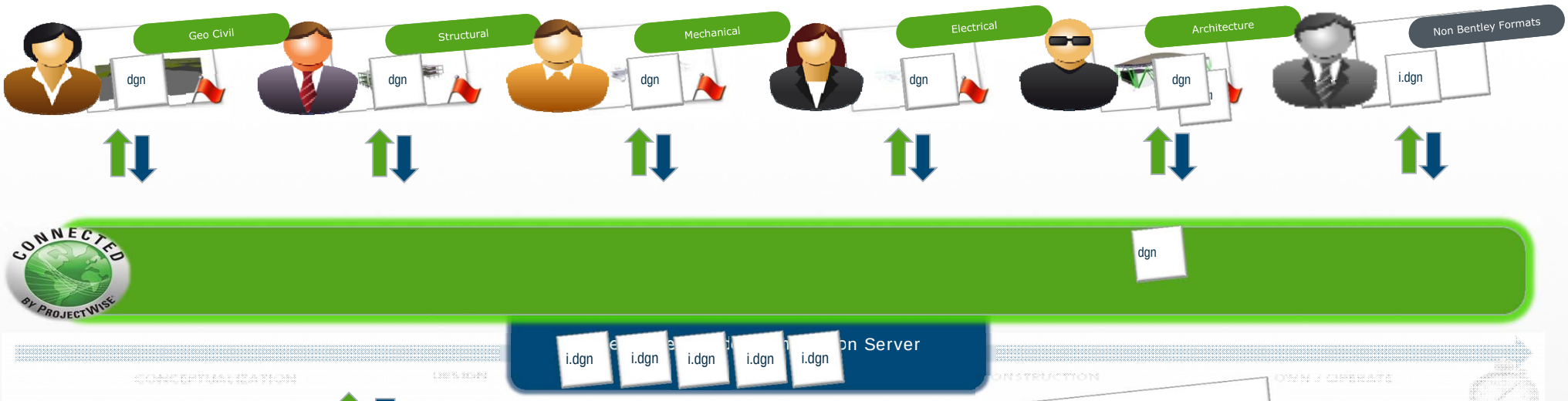
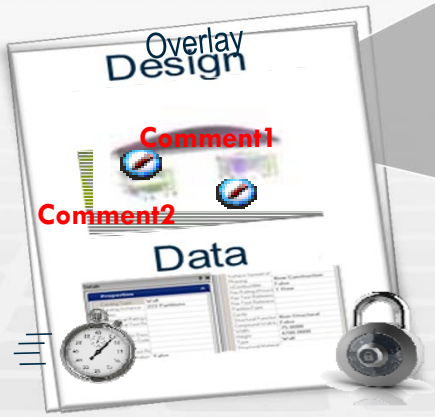
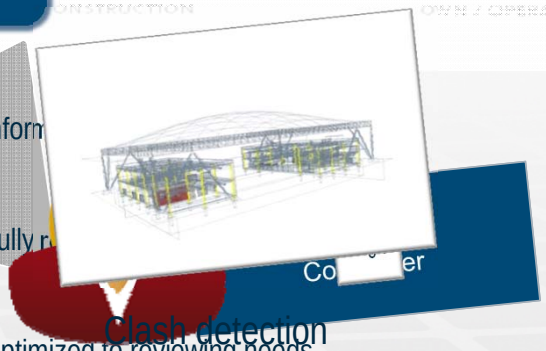
i-model Creation



Dynamic Reviewing process

Supporting the whole Lifecycle





- Inform
- Fully r
- Optimized to reviewing needs

Clash detection

Schedule Simulation

- Secure format also for archiving

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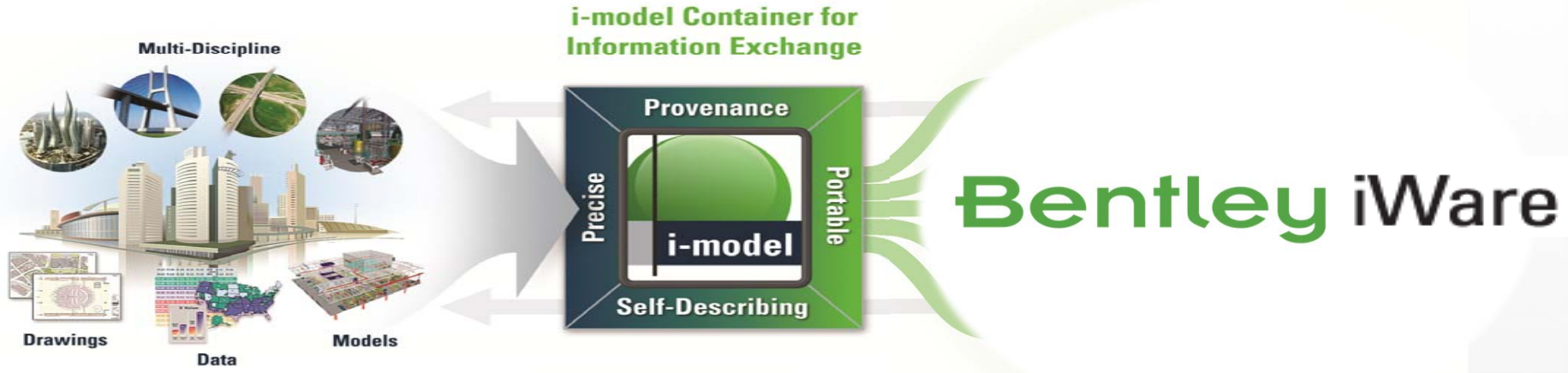
Interoperability



Extending the reach and value of information models

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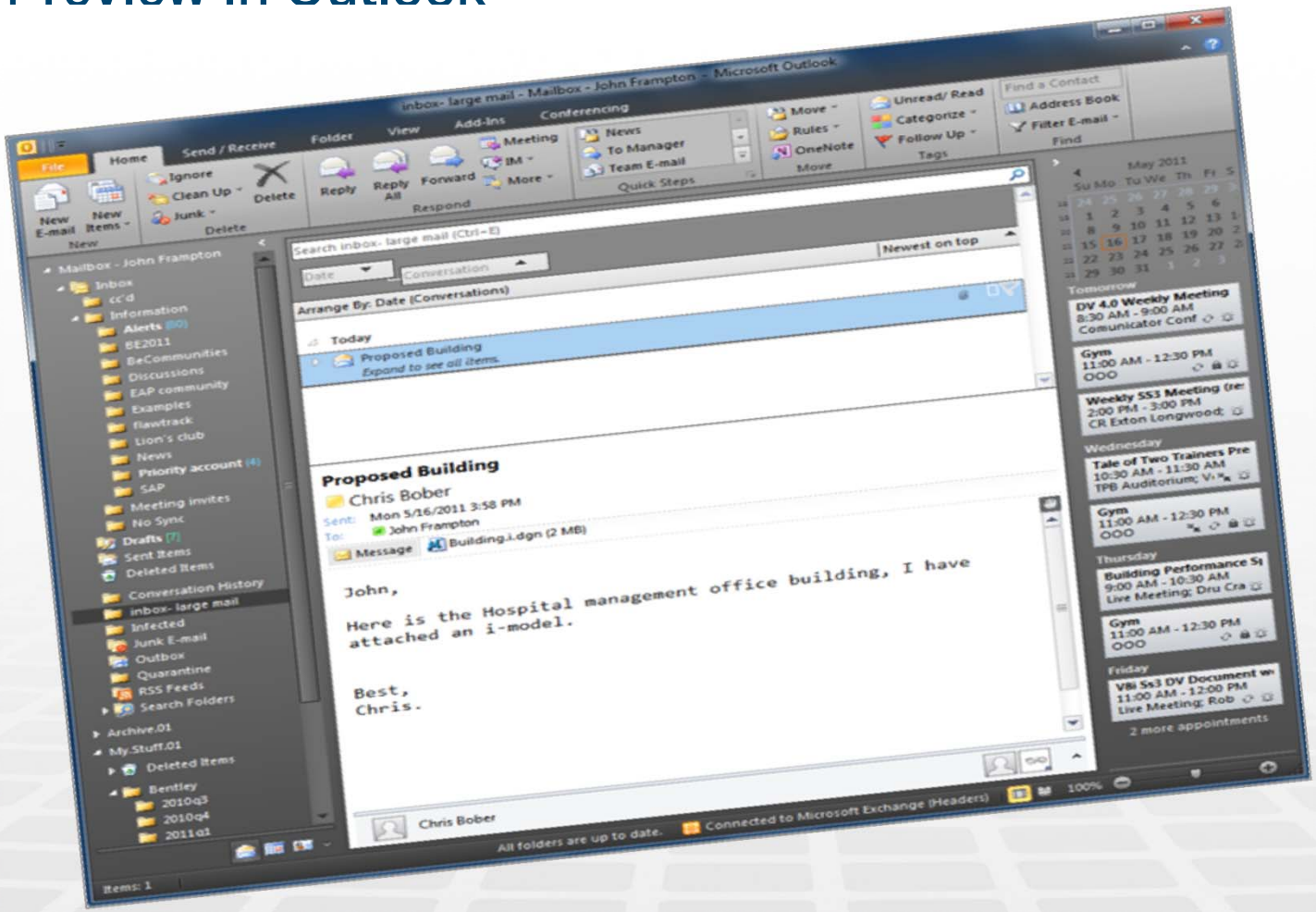
DGN Preview in Outlook



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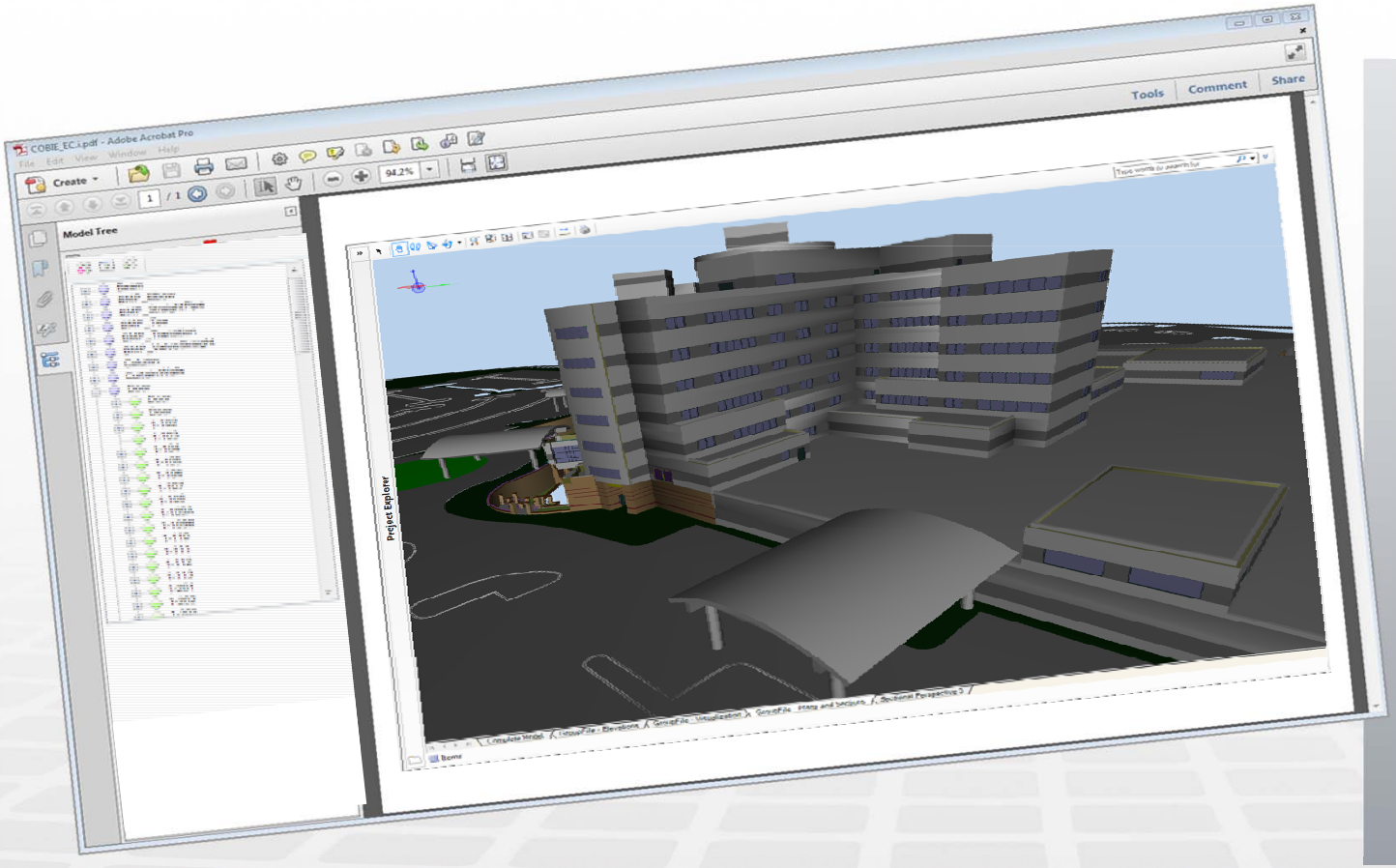
Versatile Content Re-use

i-model Plug-In for Adobe Reader



Adobe

bluebeam®

- Available as free plug-in for Adobe Reader and Bluebeam PDF Revu
- Bentley iWare

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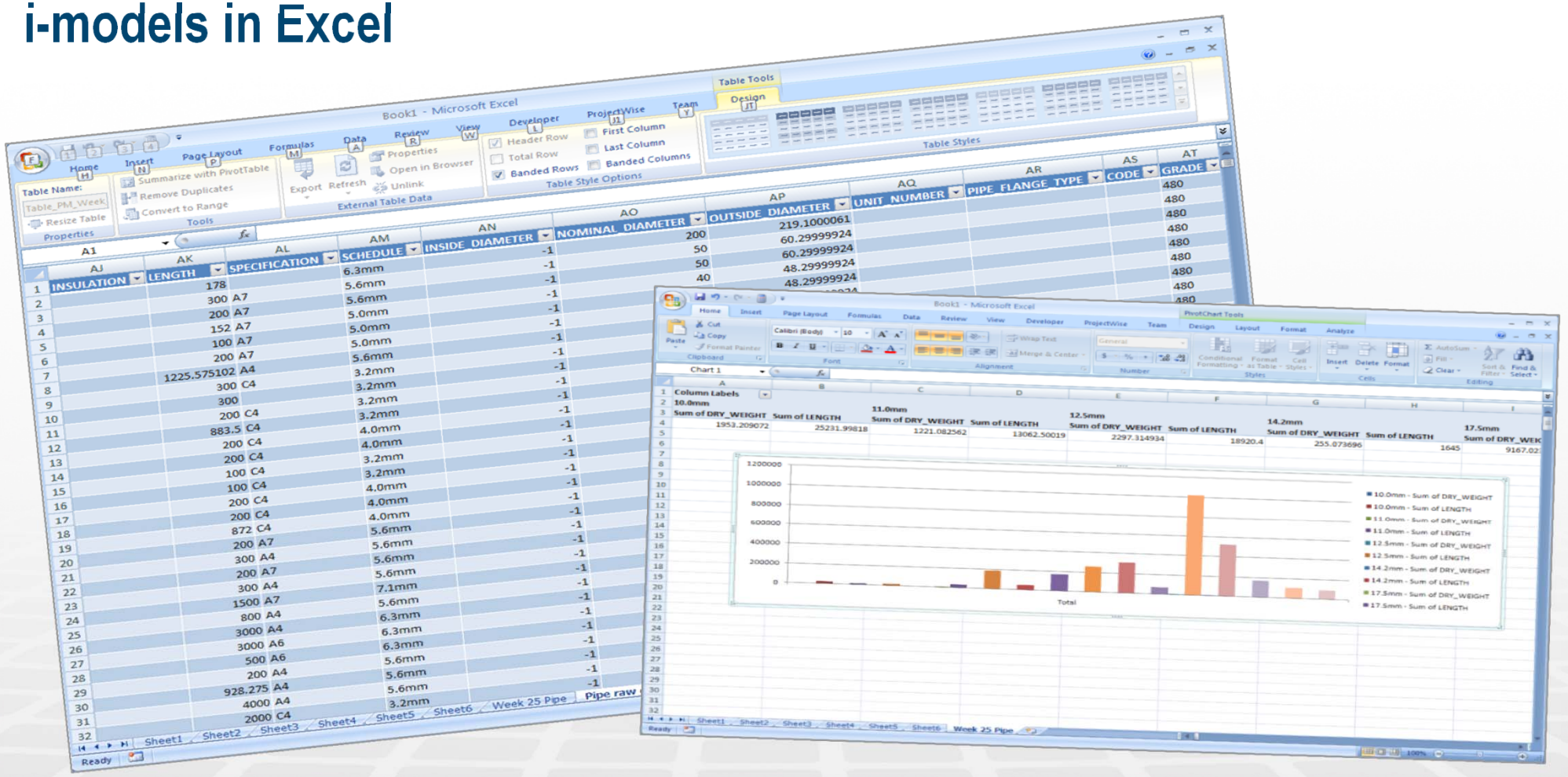
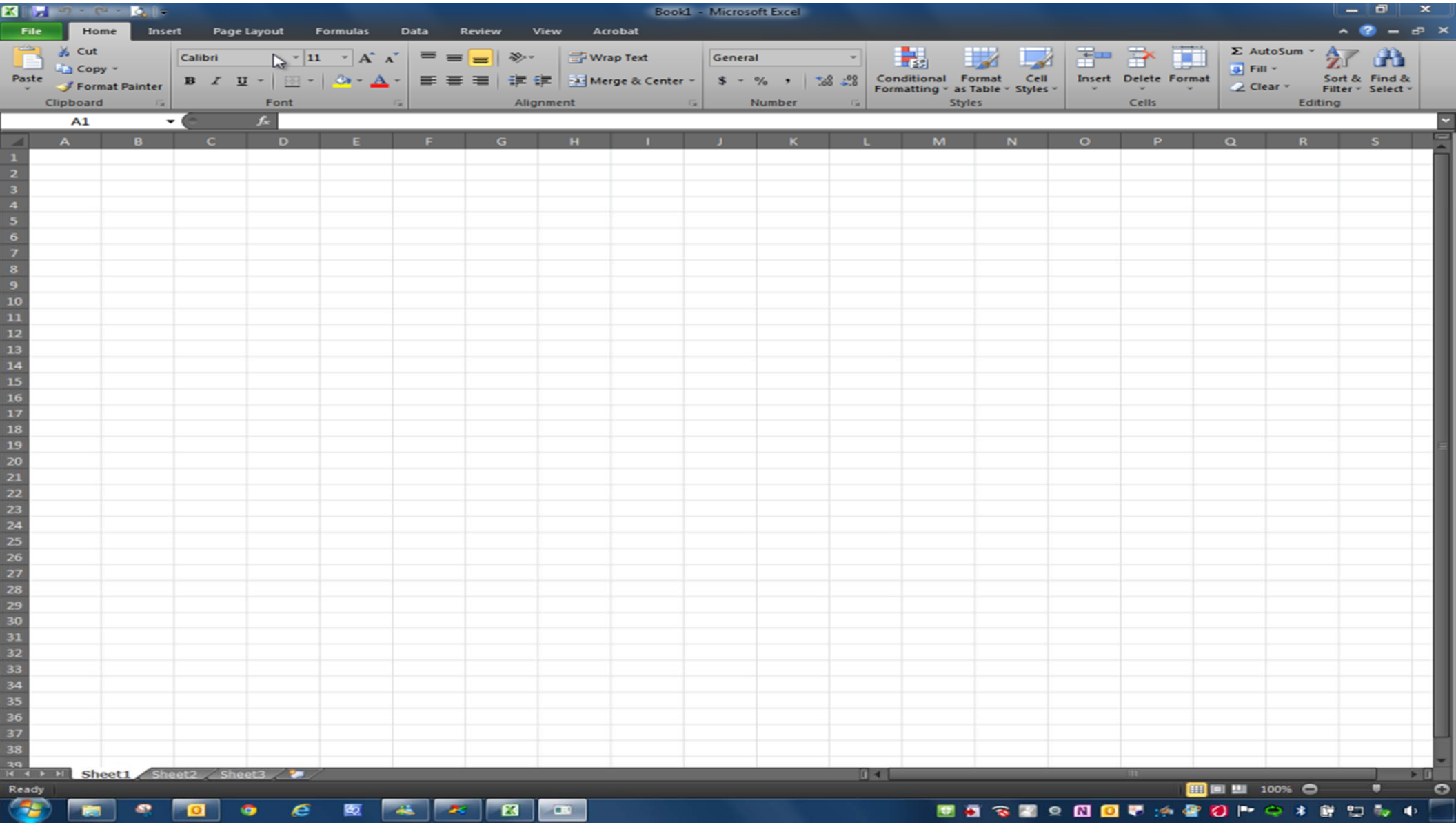
i-models in Excel



Bentley Sustaining Infrastructure


Book1 - Microsoft Excel
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View
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Font
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Merge & Center
Alignment
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Conditional Formatting
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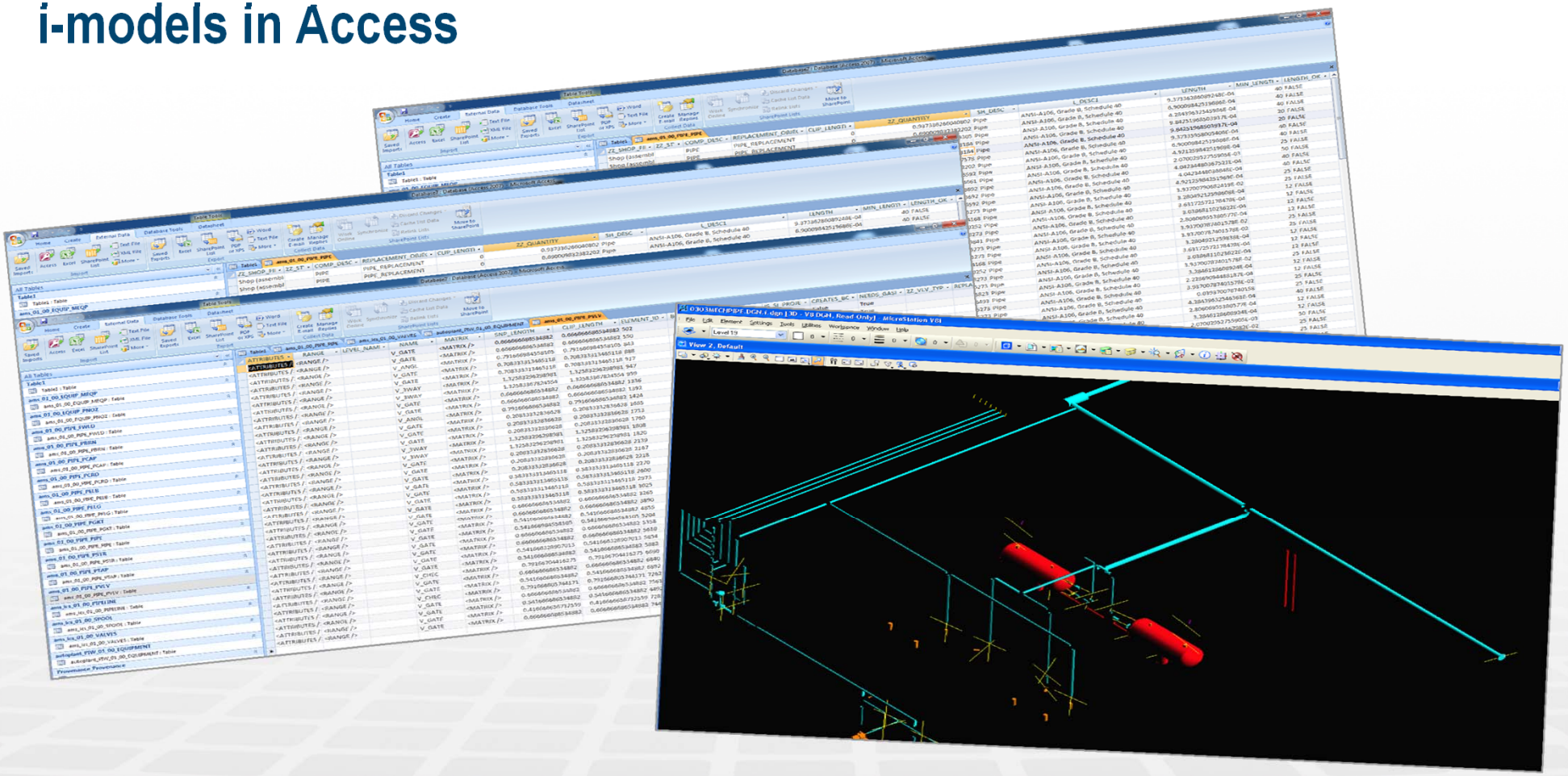
i-models in Access



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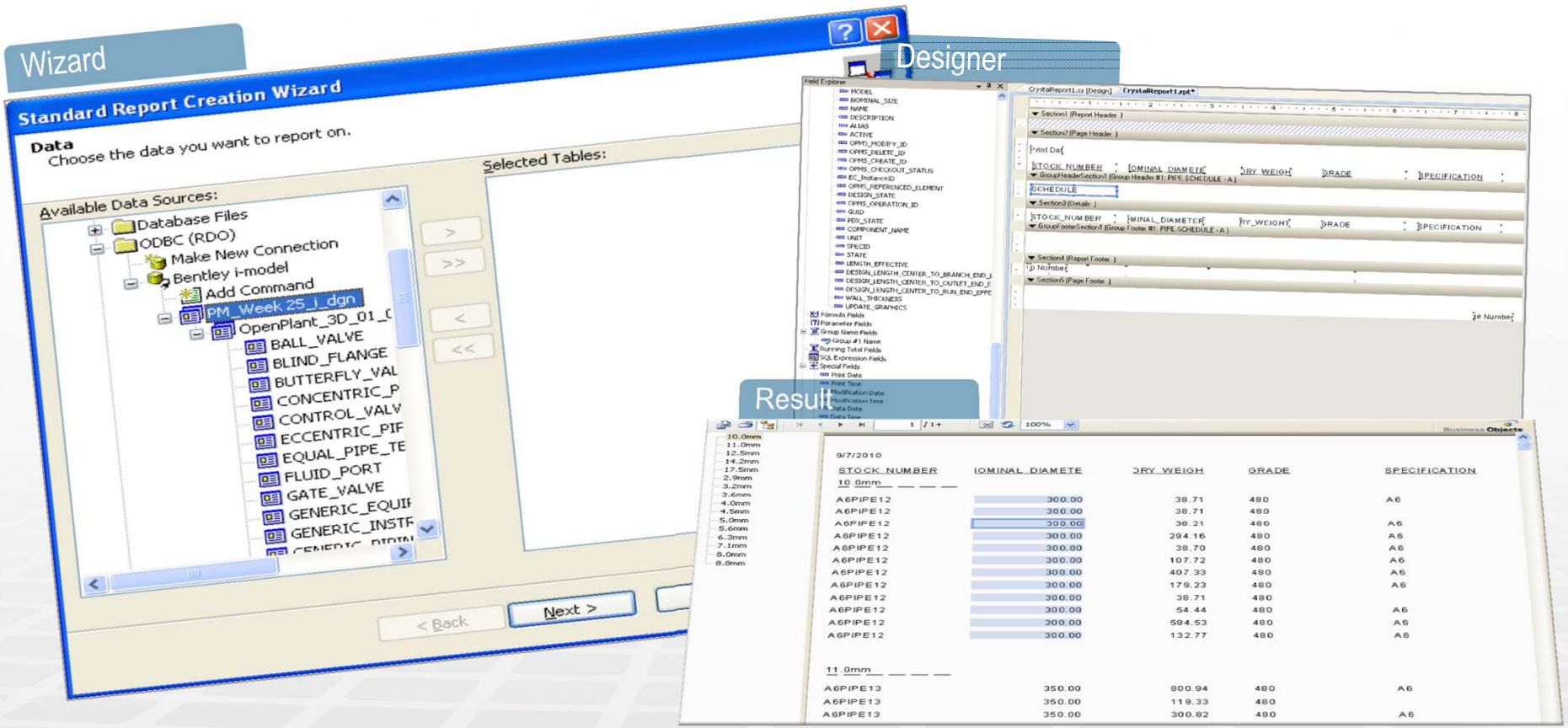
i-models in Crystal Reports



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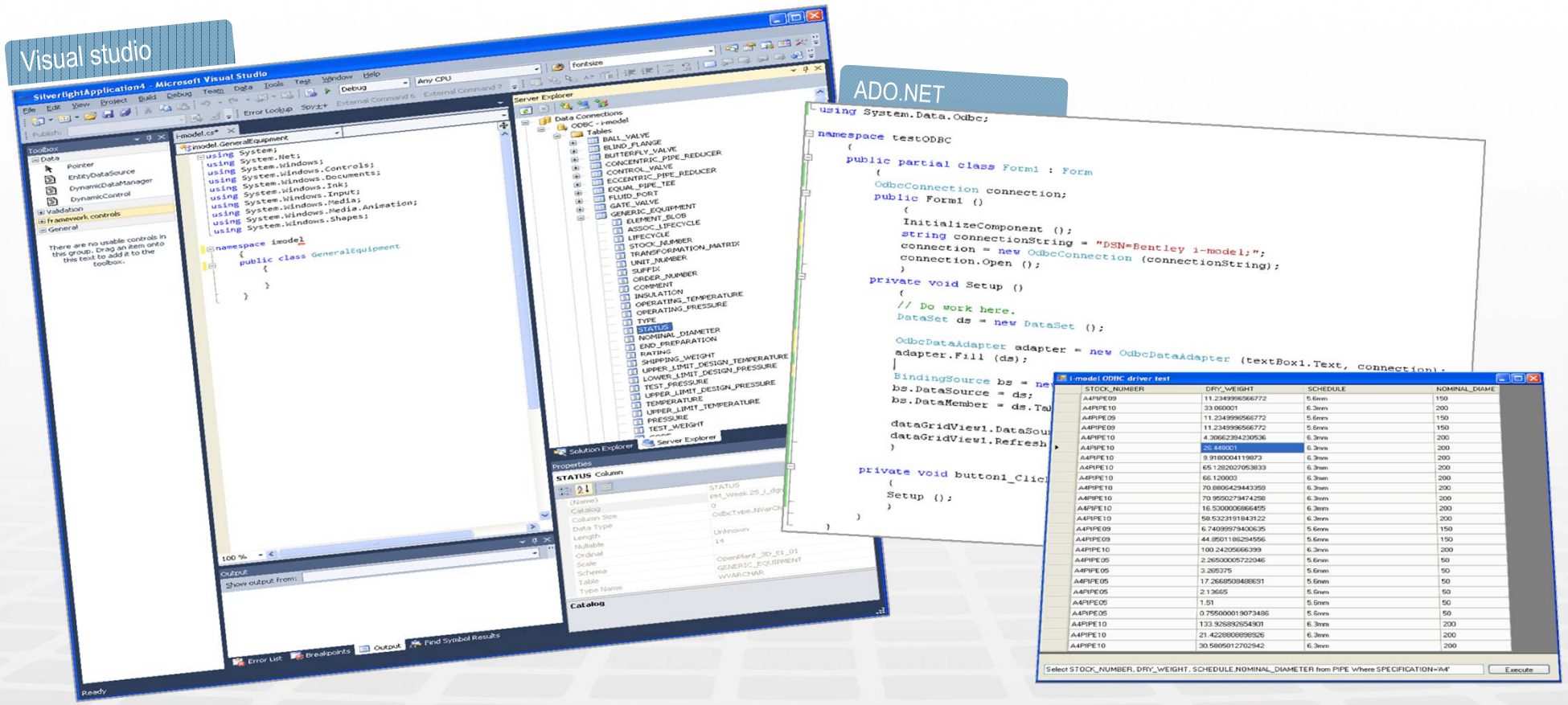
i-models in Visual Studio (VB, C#)



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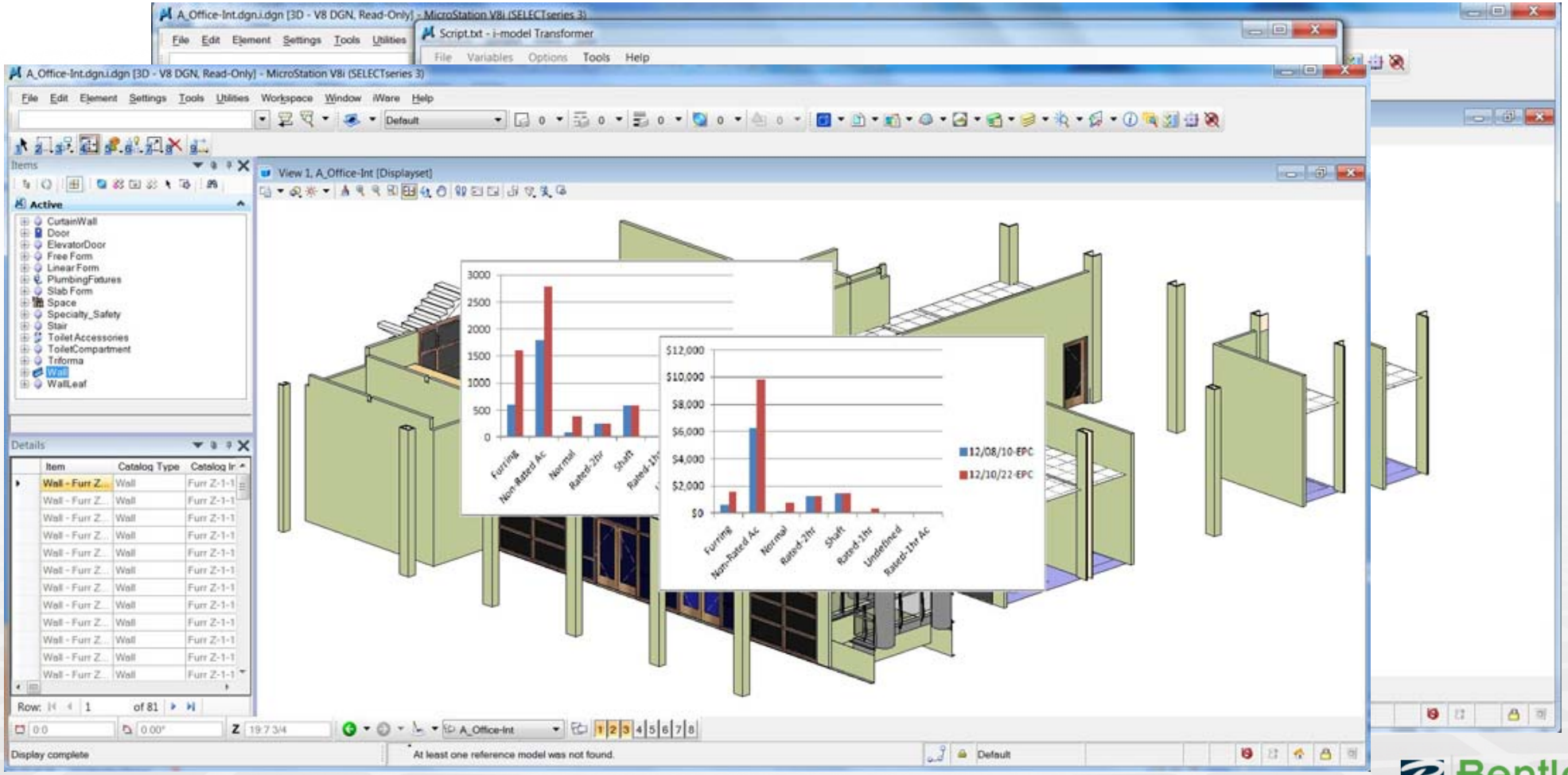
i-model Transformer



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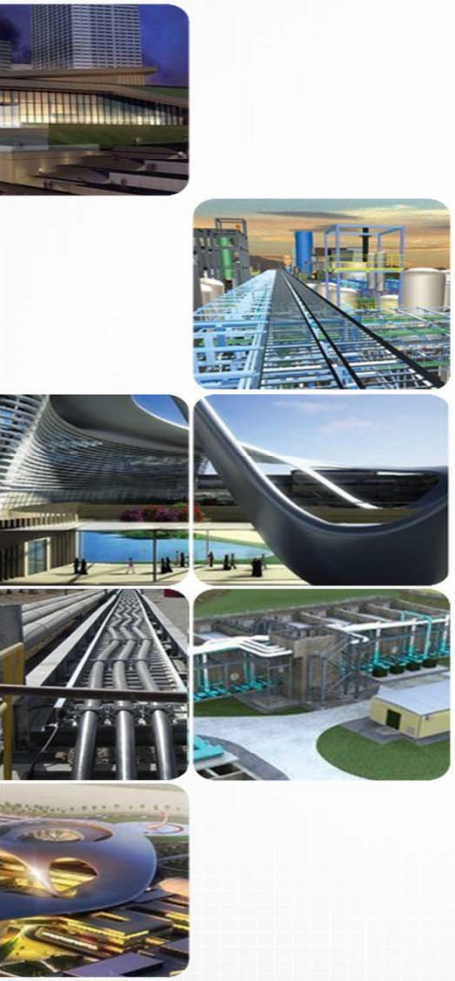

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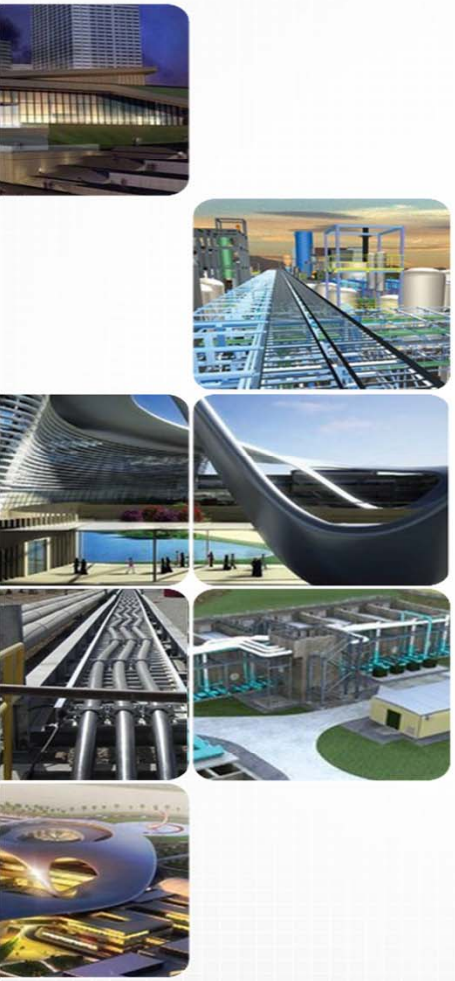

Maintaining the BIM model through construction

Transforming BIM into VCM and manage the Information Model

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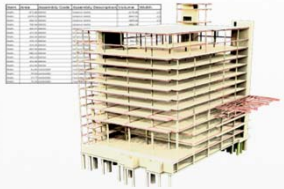
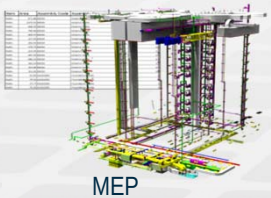
Design for Construction

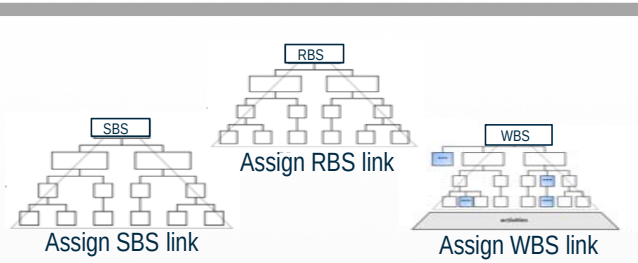
Design and Engineering factory model


Structural Steel

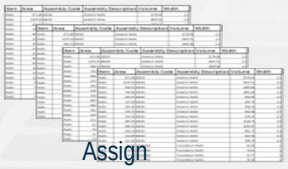

Structural Concrete


Architecture


MEP



i-model


Assign Construction Attributes


Tools for breaking up the models


VCM

- Project Scope and Planning
- 3D Visualisation
- Clash Management
- Schedule simulation
- QTO/Estimating
- Change Control
- Procurement
- Work Package Management
- Work Face Planning
- Machine Control/Stake Out
- Cost Management
- Project Control

VCM has many downstream benefits

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ProjectWise
Construction Work Package server

All work package data accessible in one place

Project info

- Project data
- Lists

Engineering

- Import/create EWP
- Engineering work packages

Work packaging

- Create work packages
- Construction work packages
- Installation work packages
- Test work packages

Construction

- Upload construction documents

Progress

- Progress reports

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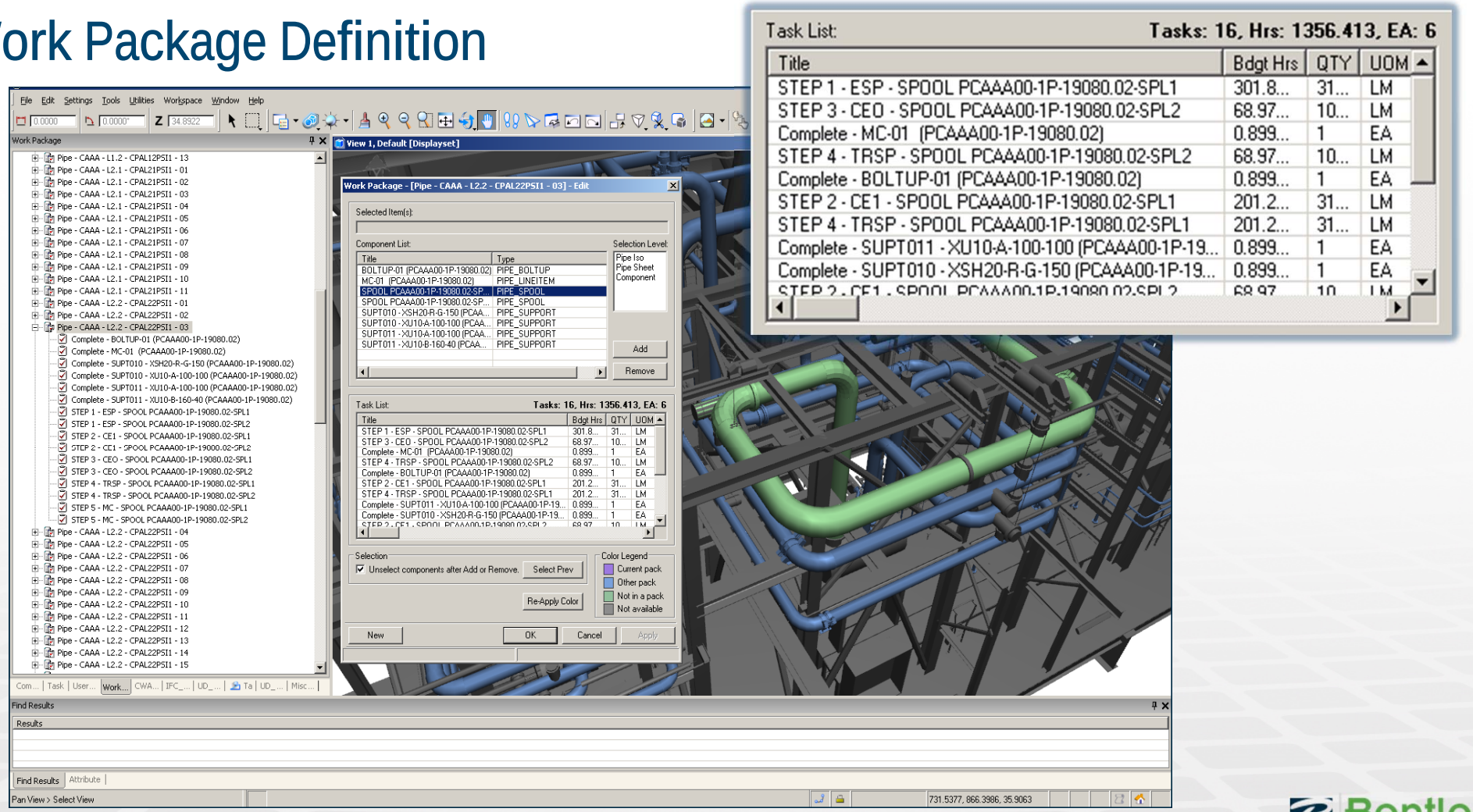
Work Package Definition



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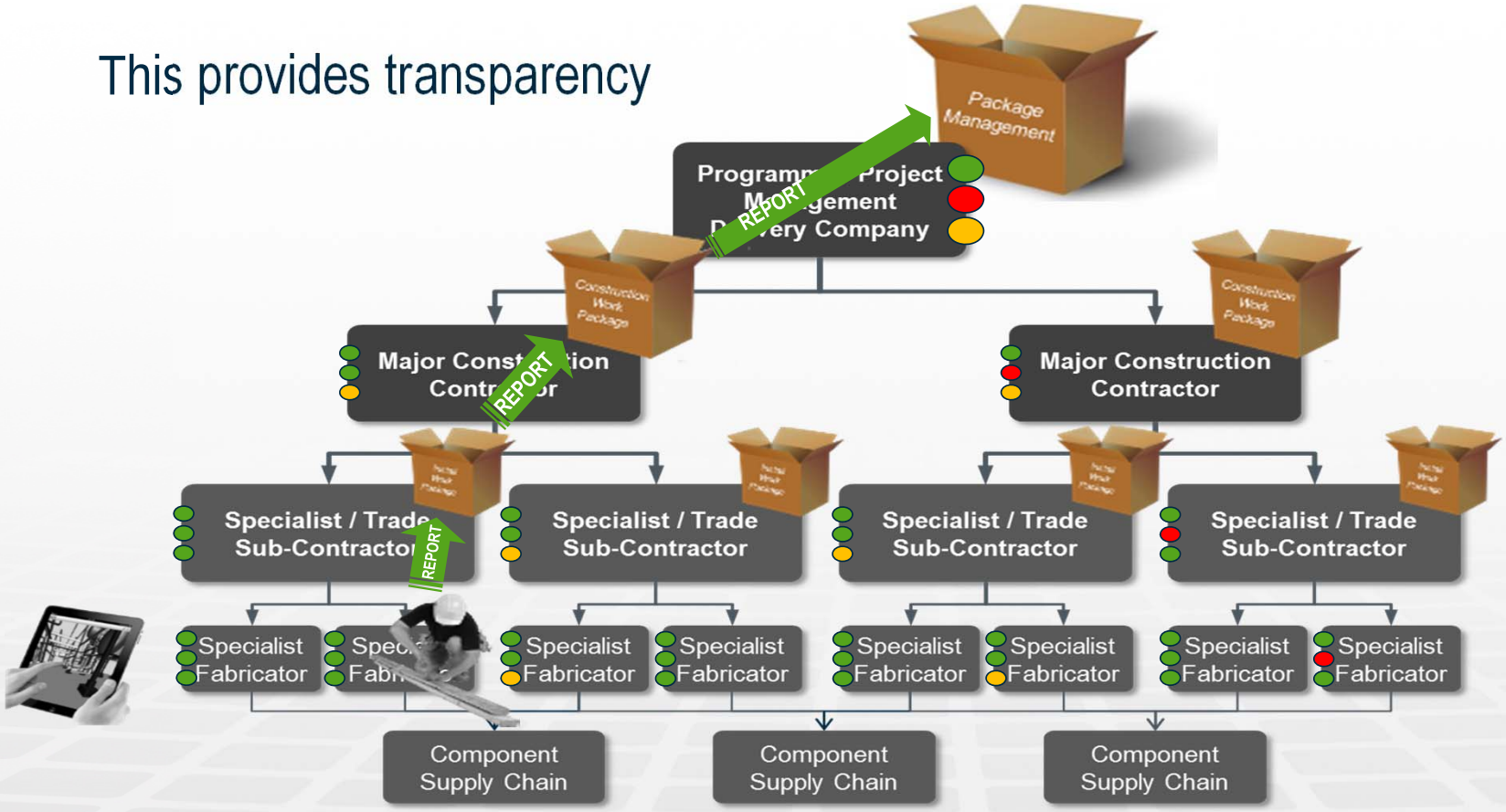
Information distribution workflow ...

This provides transparency



Engineering Work Package

Construction Work Package

Installation Work Package

Progress, QA/QC on-site

Increasing levels of detail

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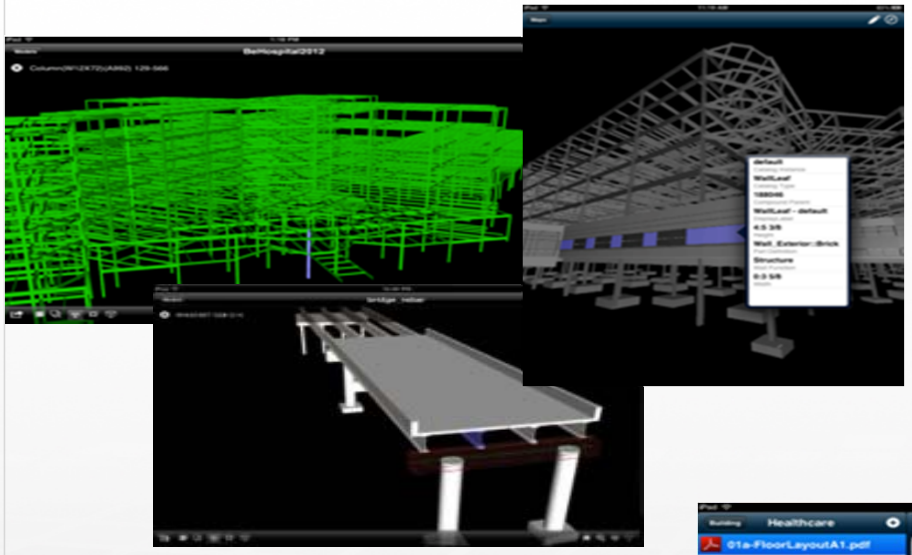
Types of Bentley Apps

Inspections



Graphically Rich

Project Data Access

Bentley Sustaining Infrastructure

Bentley Mobile Apps

APM Supervisor Dashboard	At-a-glance, actionable, 24x7 view of asset health
Field Supervisor	Create personalized views into project data
InspectTech Collector Mobile	Inspect transportation assets, capture photos, and create reports
Bentley Map Mobile	View *Bentley Map* information models
Navigator Mobile	Review 3D models and documents
Navigator Pano Review	Review 3D design models
ProjectWise Explorer Mobile	Create, browse, and view ProjectWise documents
Structural Synchronizer View	View structural models

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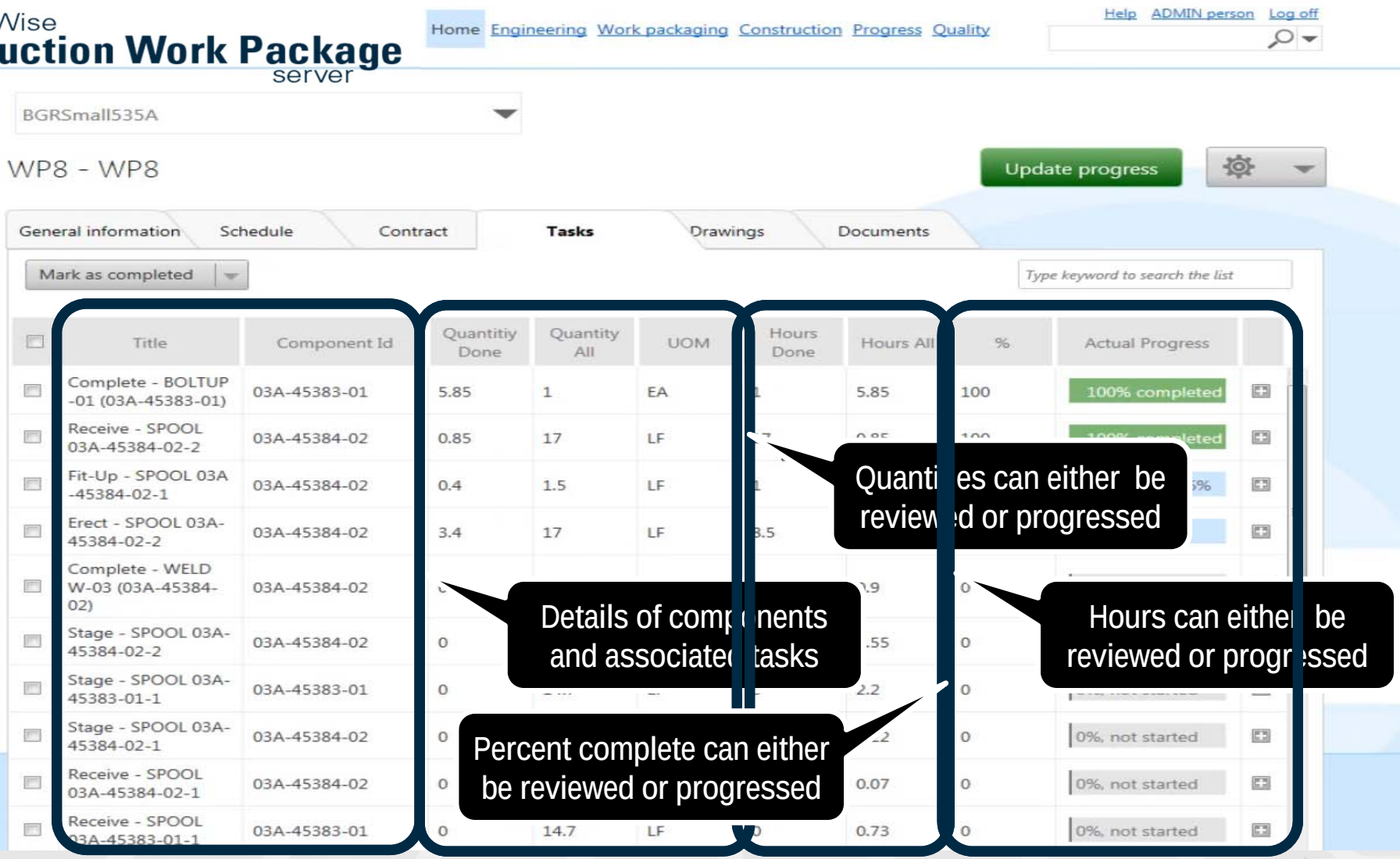
ProjectWise
Construction Work Package server



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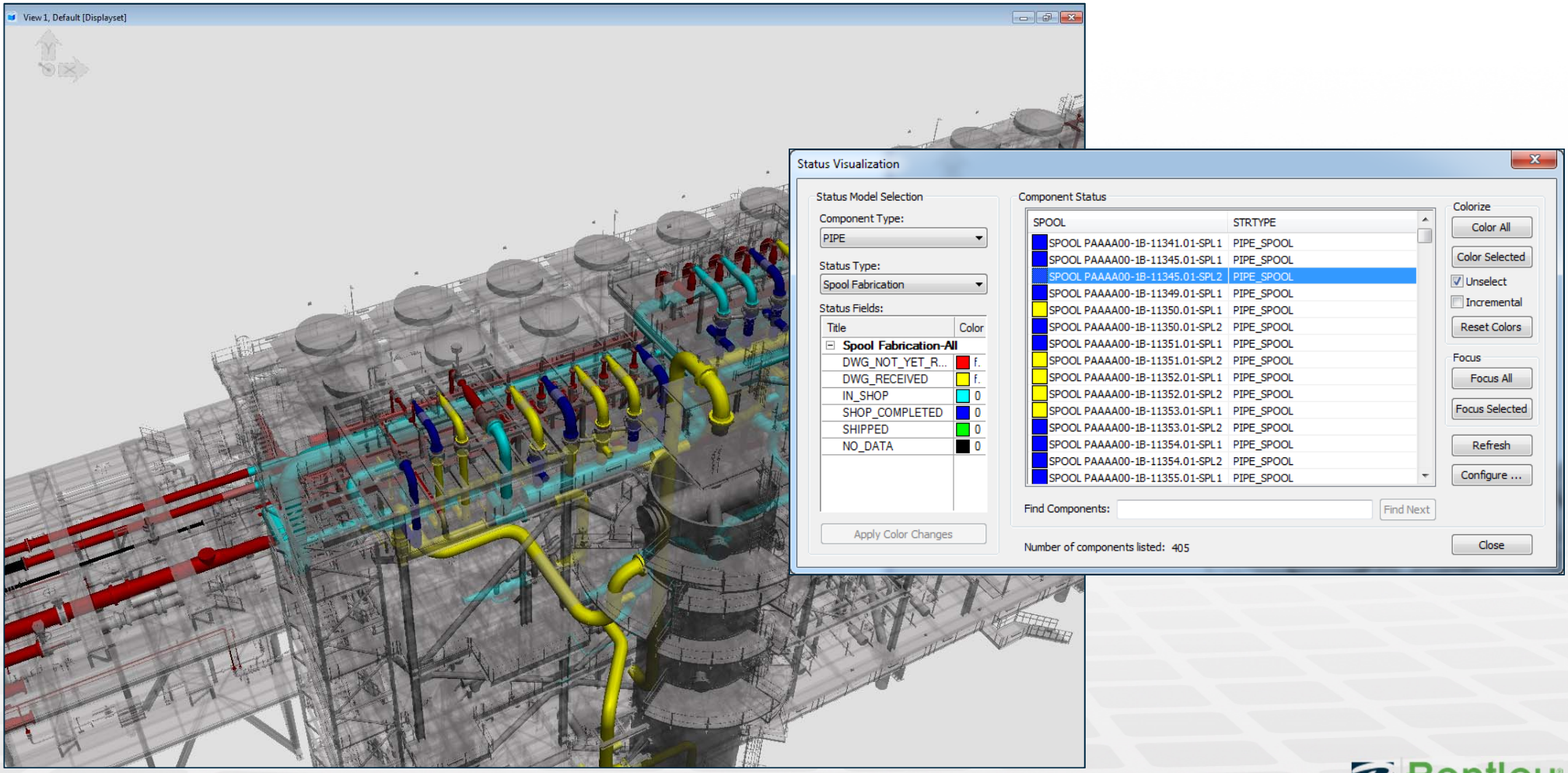
Status Visualization



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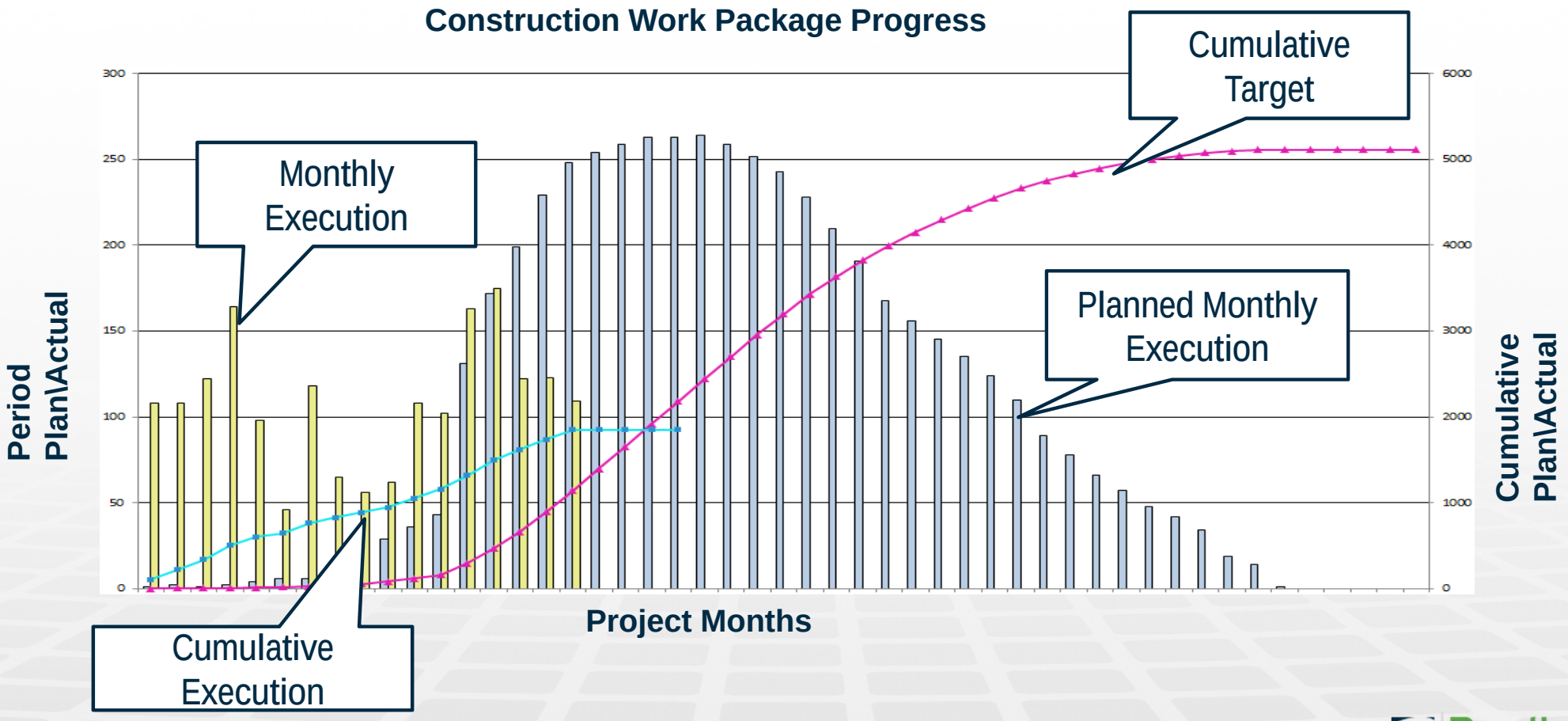
Reporting Progress vs. Plan



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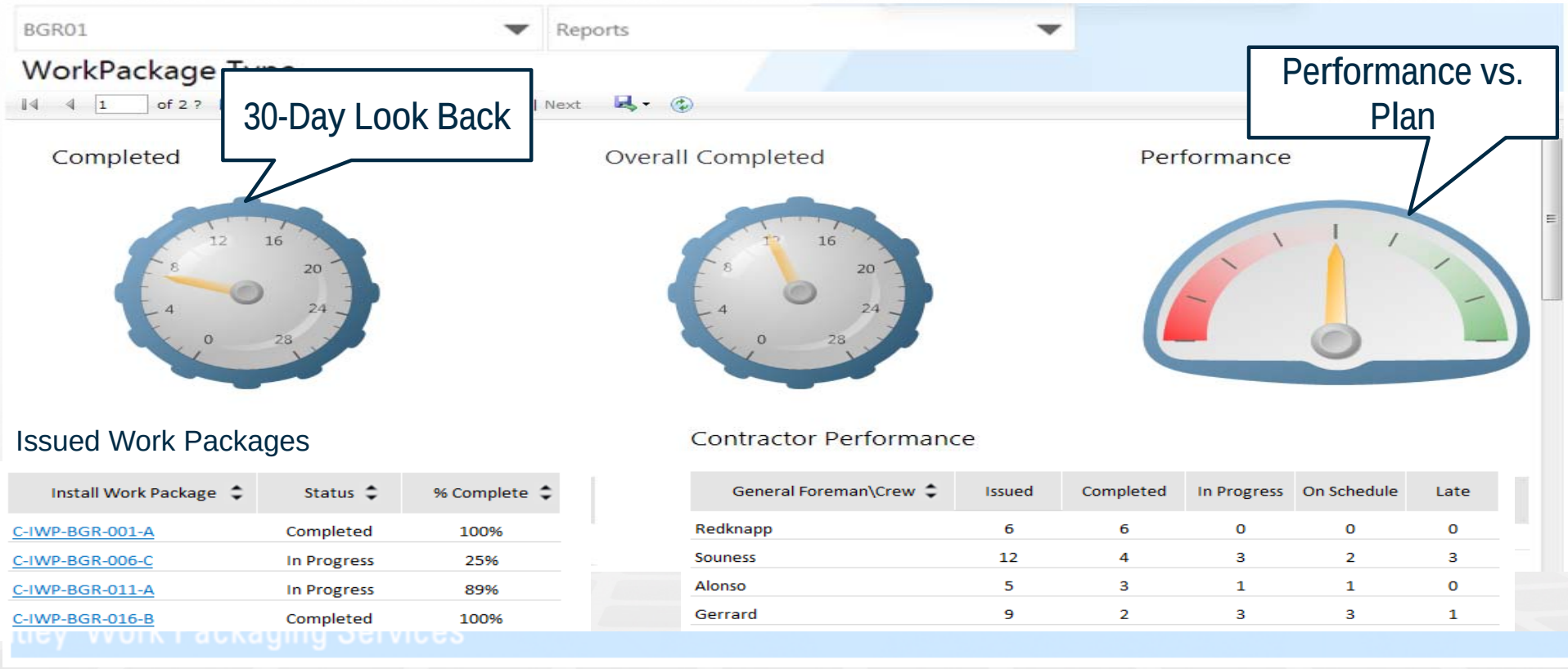
Concrete Contractor Evaluation Dashboard



Issued Work Packages

Install Work Package	Status	% Complete
C-IWP-BGR-001-A	Completed	100%
C-IWP-BGR-006-C	In Progress	25%
C-IWP-BGR-011-A	In Progress	89%
C-IWP-BGR-016-B	Completed	100%

Contractor Performance

General Foreman\Crew	Issued	Completed	In Progress	On Schedule	Late
Redknapp	6	6	0	0	0
Souness	12	4	3	2	3
Alonso	5	3	1	1	0
Gerrard	9	2	3	3	1

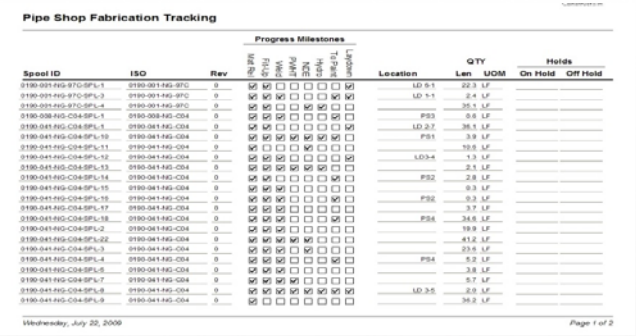
Configurable Reports / Scorecards

Material Lists

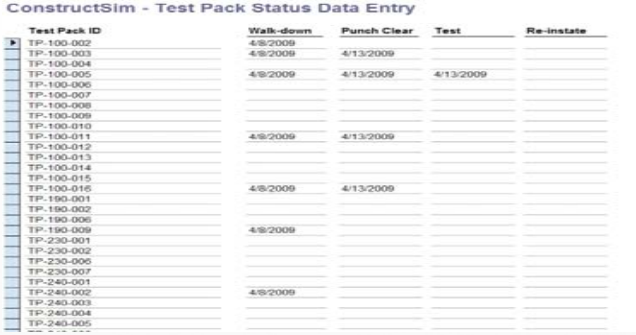

Pipe Work Pack - Spool List

Spool List
Work Pack: P - FIWP - CWA 01 - 006

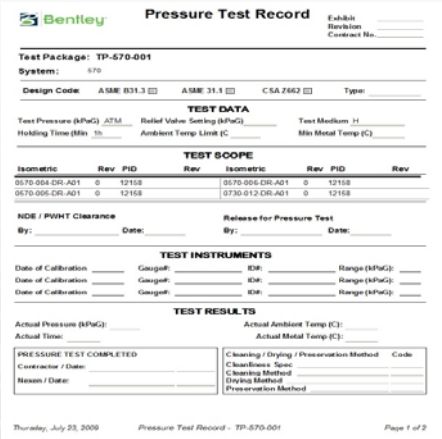
Progress Reporting


Pipe Shop Fabrication Tracking

Progress Test Certificate


ConstructSim - Test Pack Status Data Entry

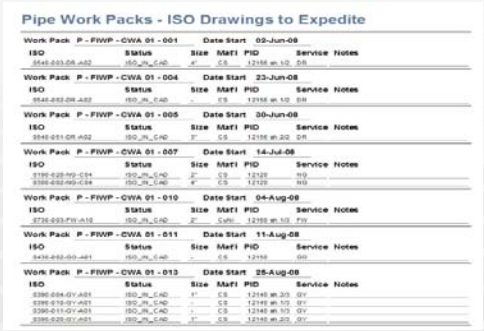
Pressure Test Record


Pressure Test Record

Test Package: TP-570-001

Expedited Reports

Drawings Not Yet Released

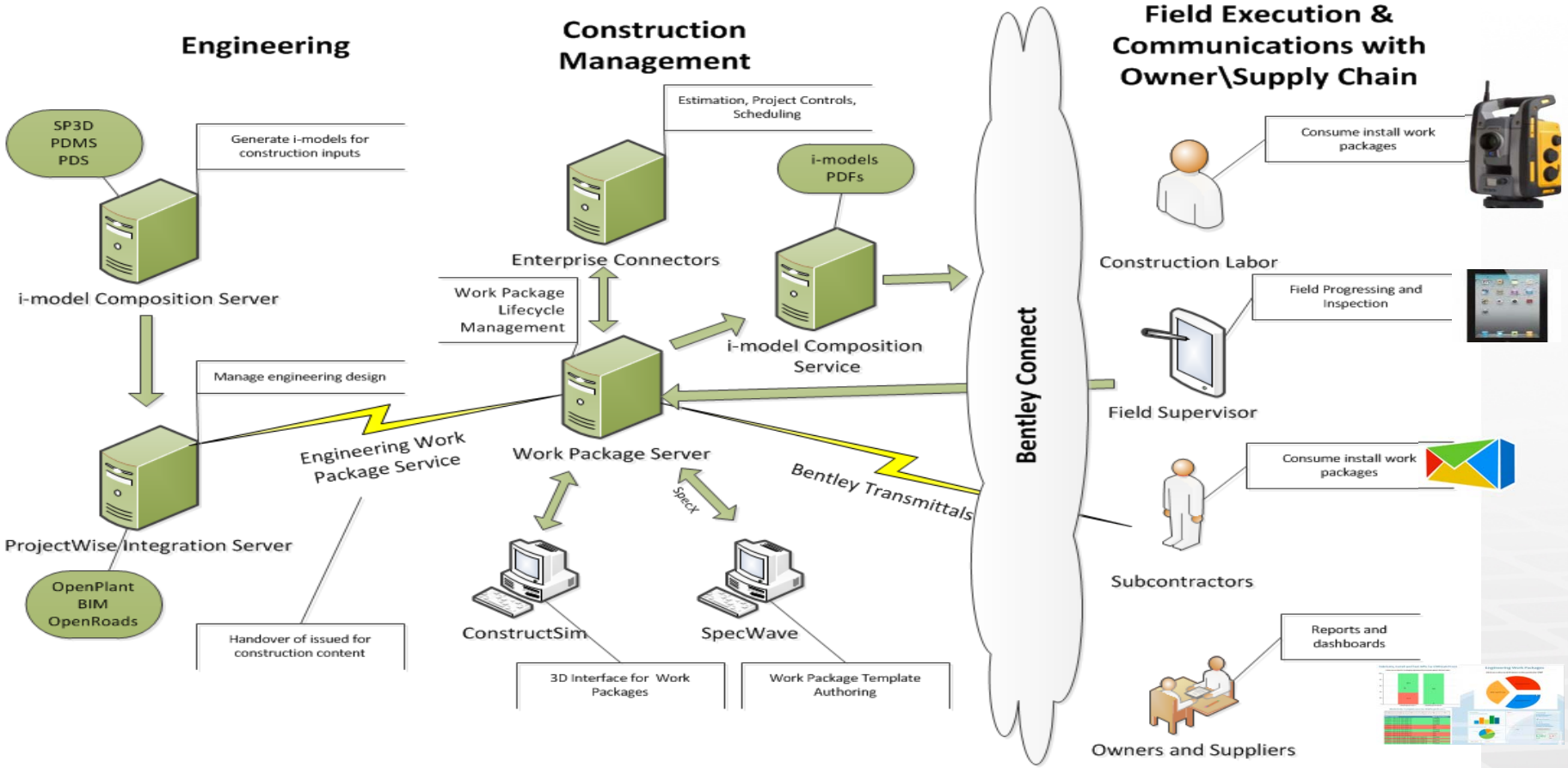

Pipe Work Packs - ISO Drawings to Expedite

Spools Not Yet Fabricated


Pipe Work Packs - Spools to Expedite

Bentley Sustaining Infrastructure

Solution Overview

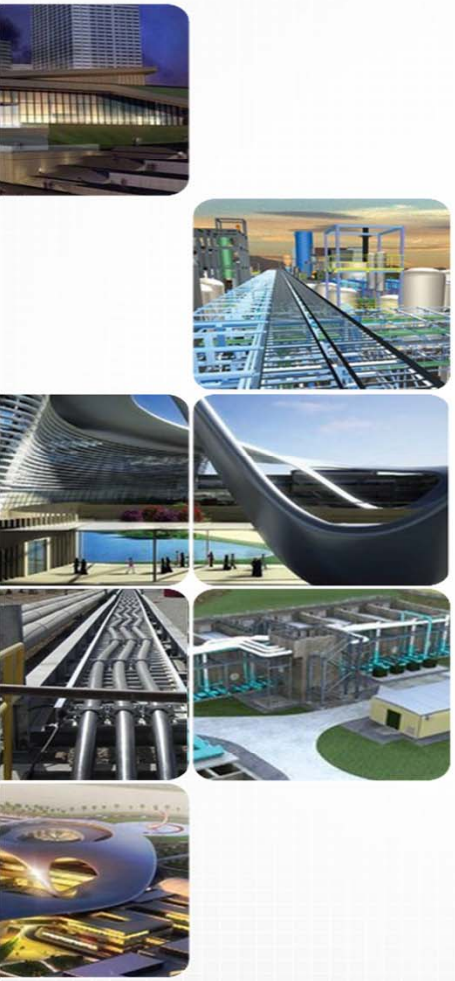


Bentley Sustaining Infrastructure

Accompanying as built documentation

Courtesy of Volvo Cars

Bentley Sustaining Infrastructure



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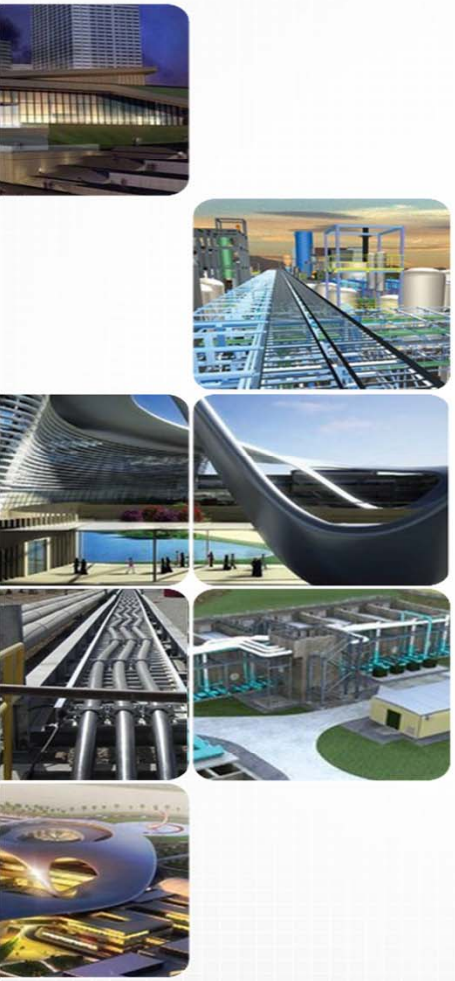
Sustaining Infrastructure

Compare As-Designed vs. As-Built

Courtesy of Volvo Cars

Bentley Sustaining Infrastructure

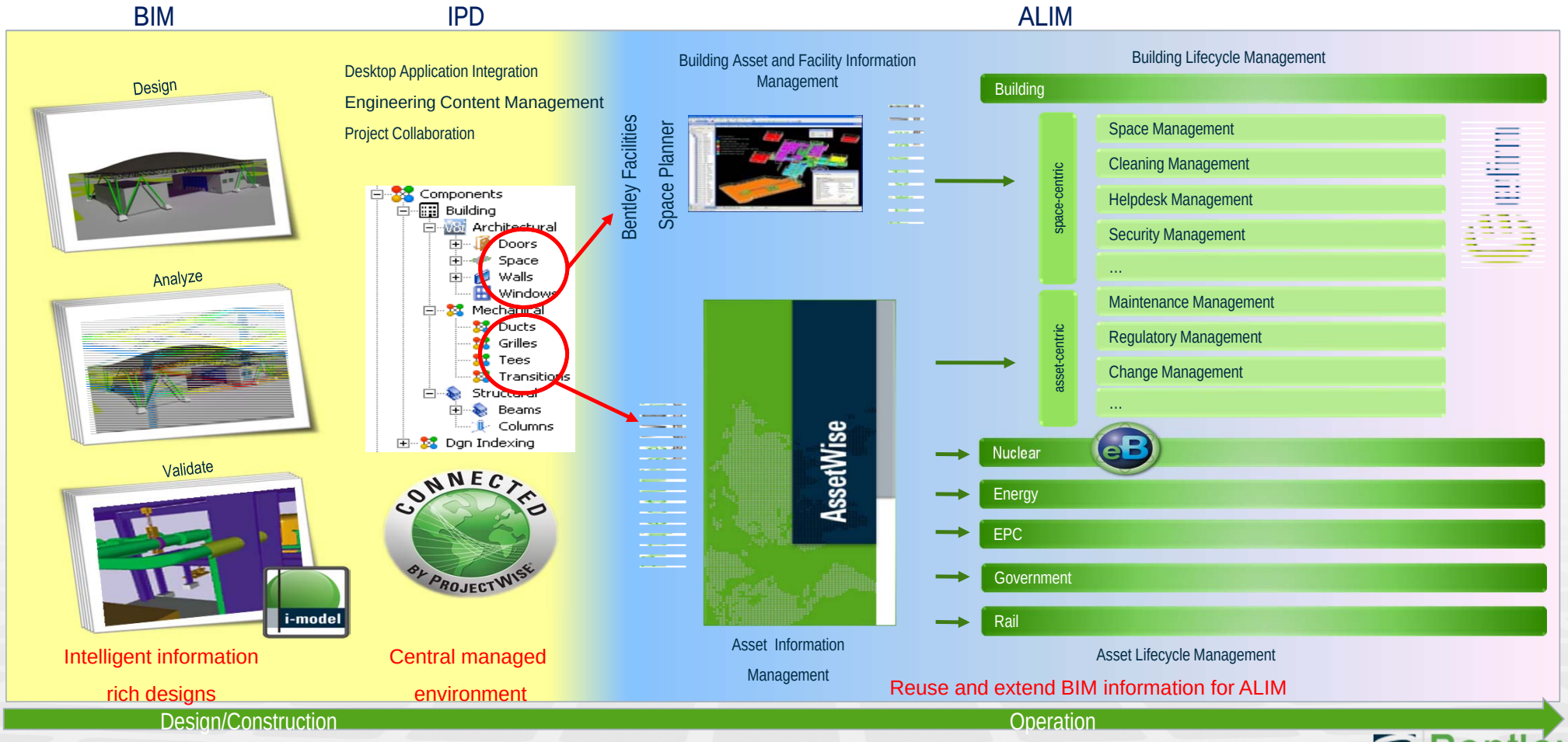


Connecting the as-built BIM model with operational systems

enterprise Bridge (eB) – bridging the information gap

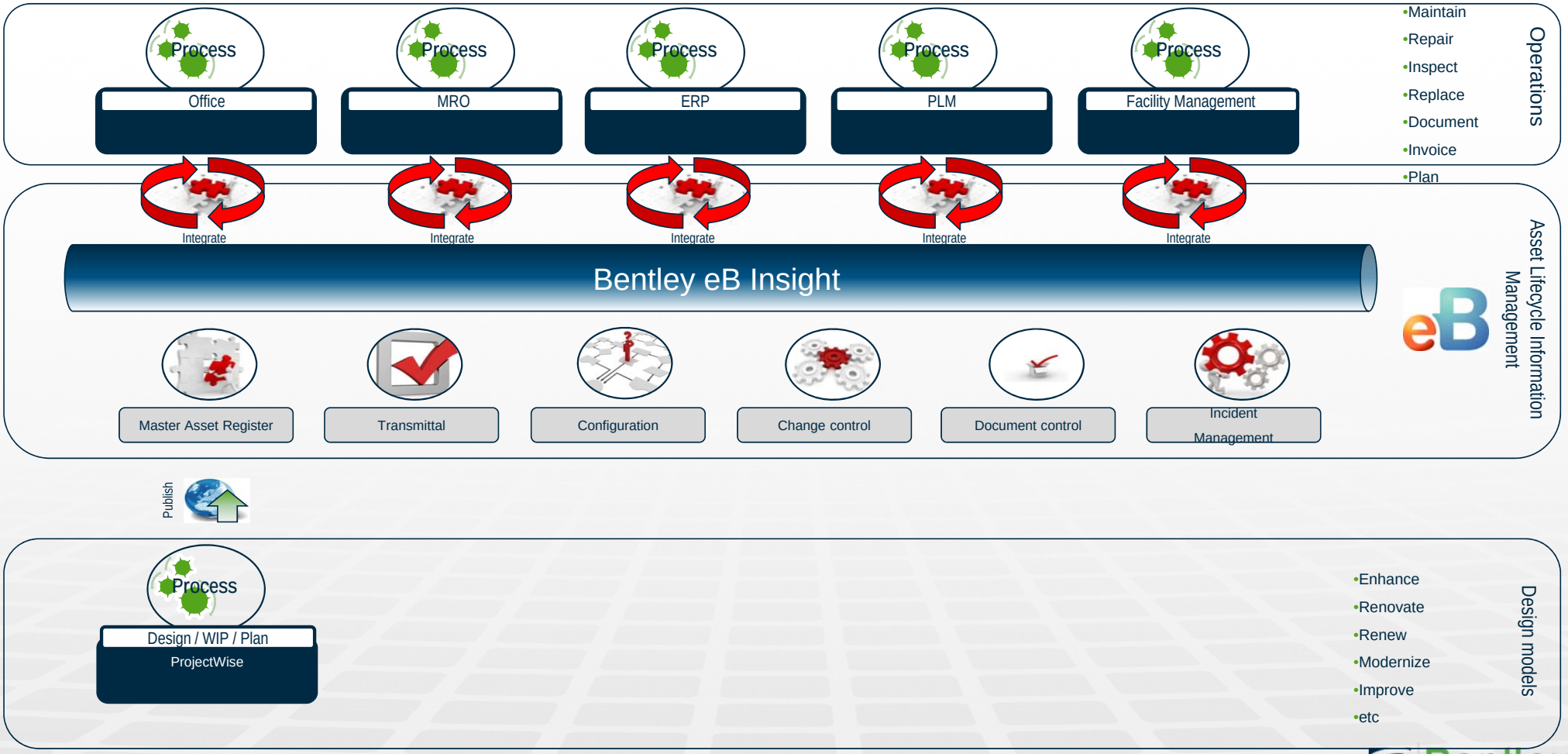
Bentley Sustaining Infrastructure

Use of Planning Information for Documentation and Asset Lifecycle Management



Bentley Sustaining Infrastructure

eB – enterprise solution architecture

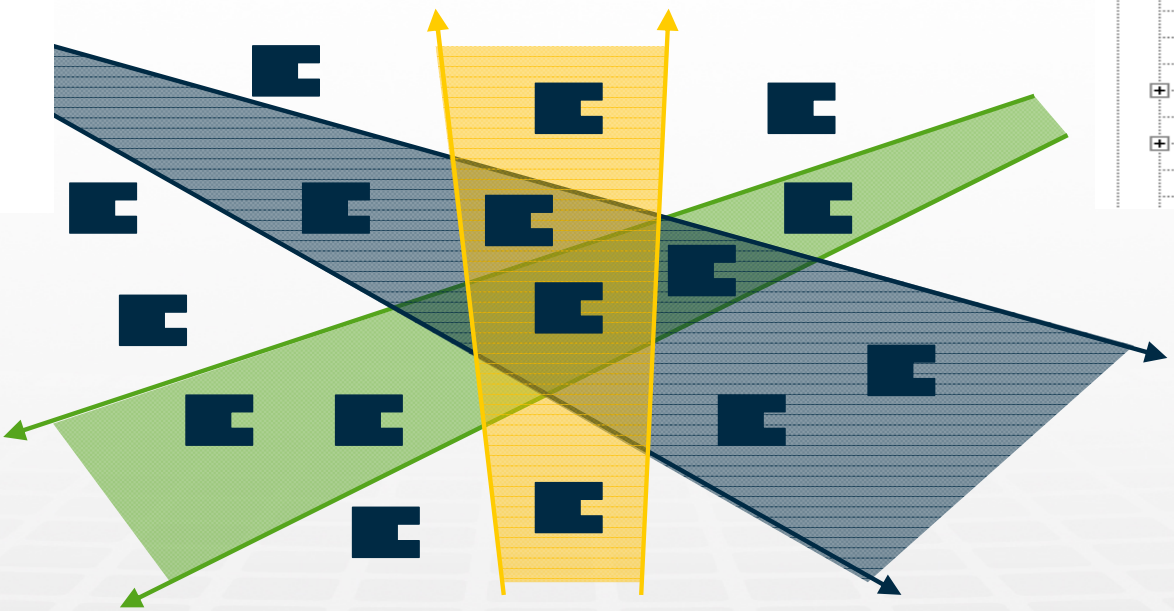


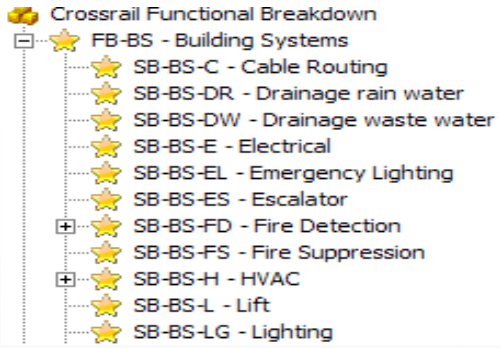
Flexibility with Data

Location

Where is the asset?

Pool of Asset Tags



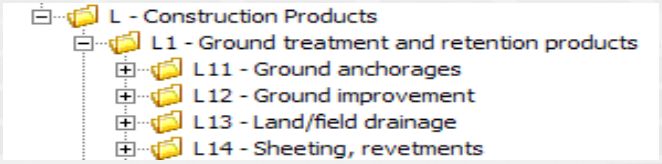


Function

What is the asset designed to perform?

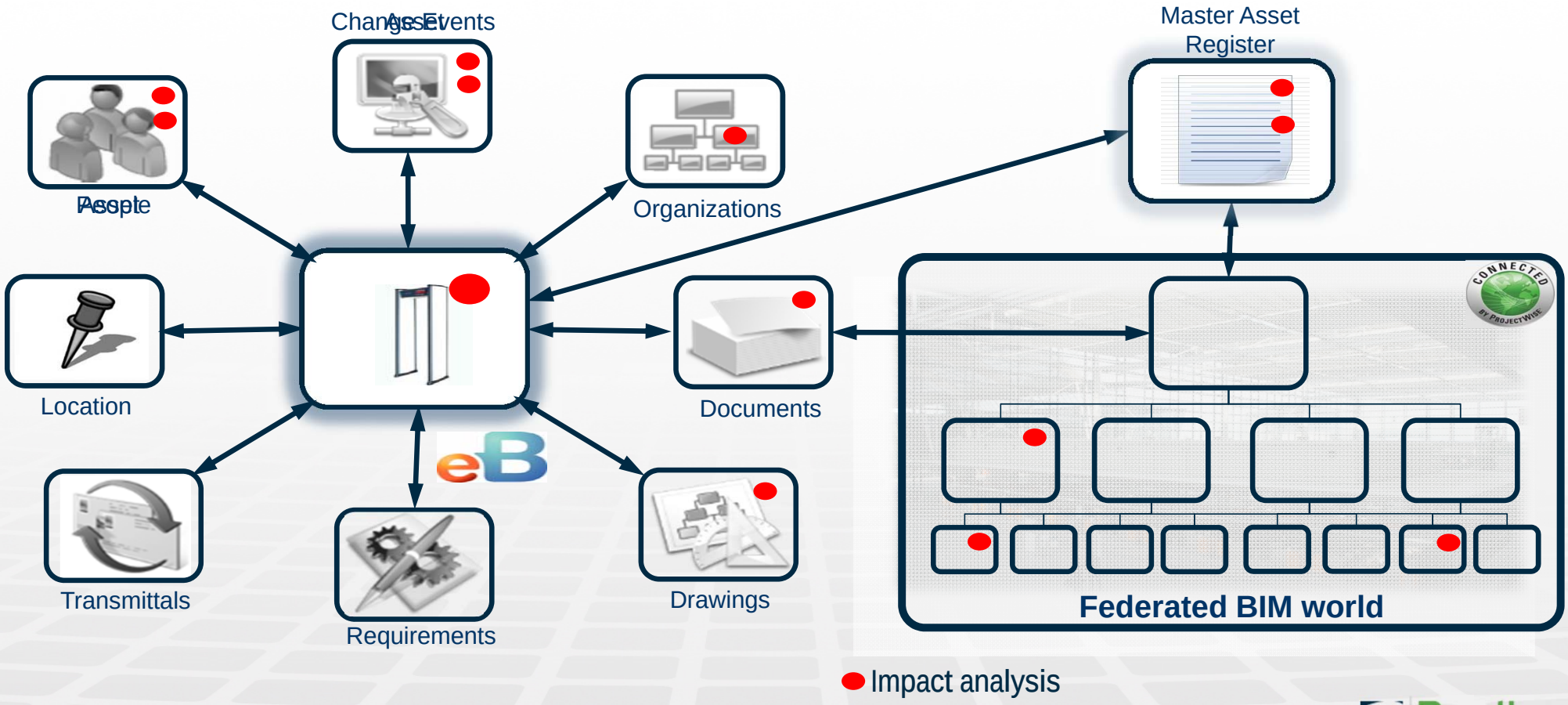
Classification

What type of asset is it?

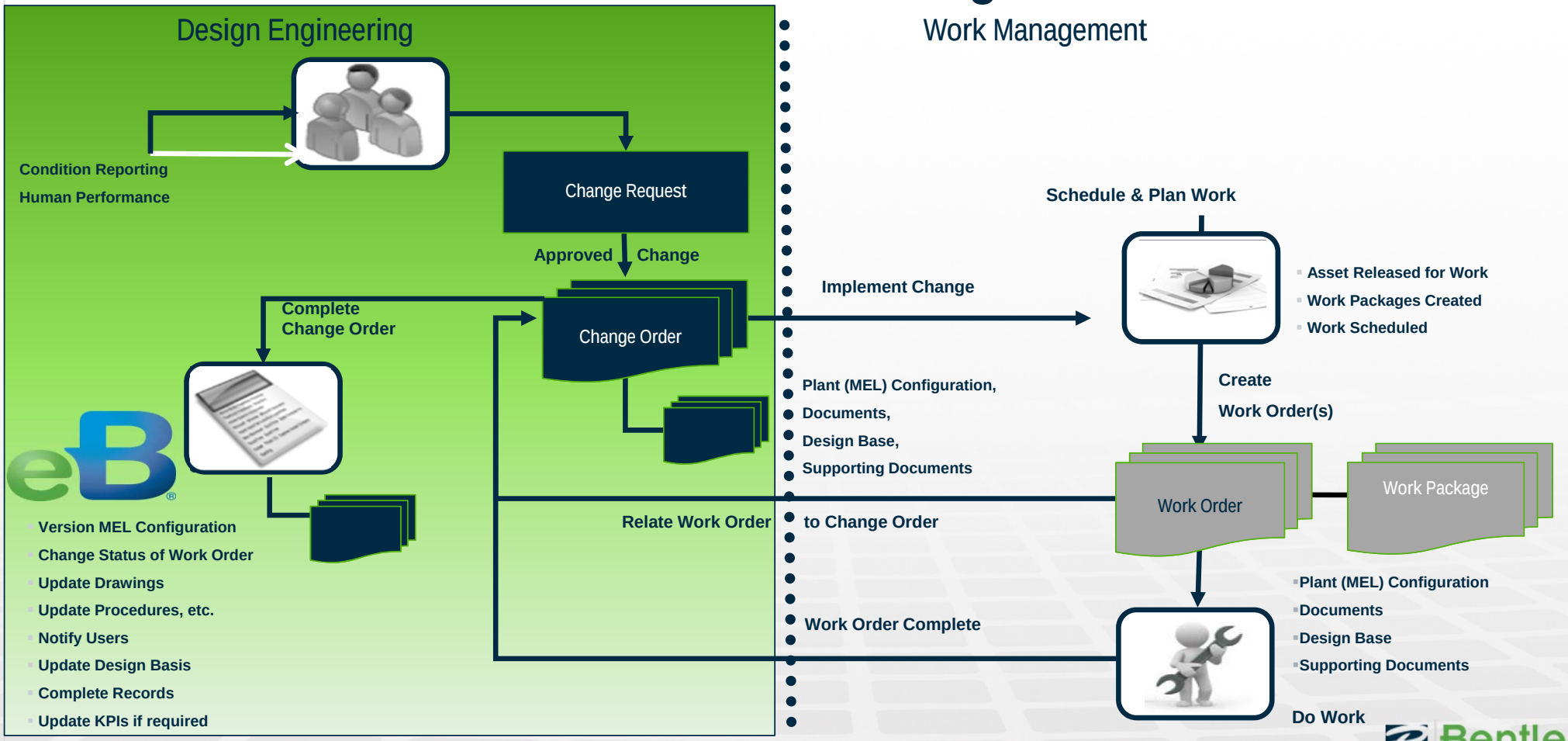


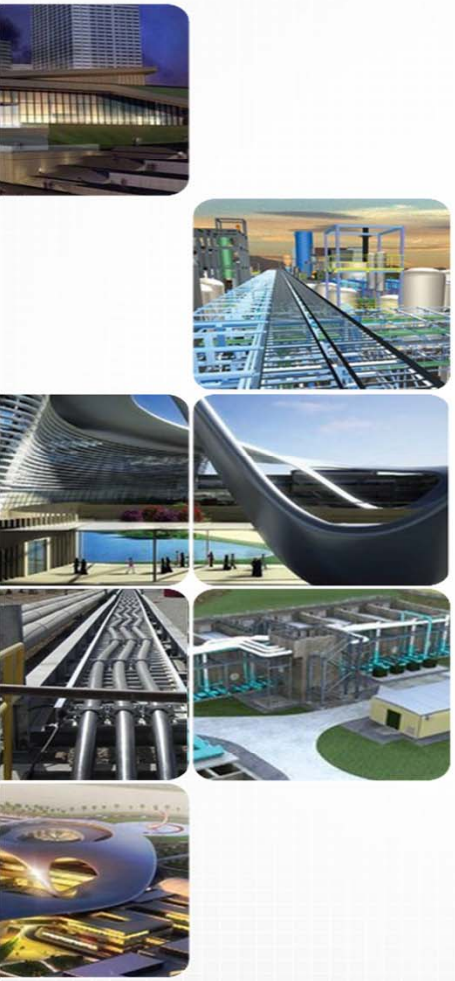
Bentley Sustaining Infrastructure

Bentley eB bridging the information gap



Solution Architecture – Incident Management





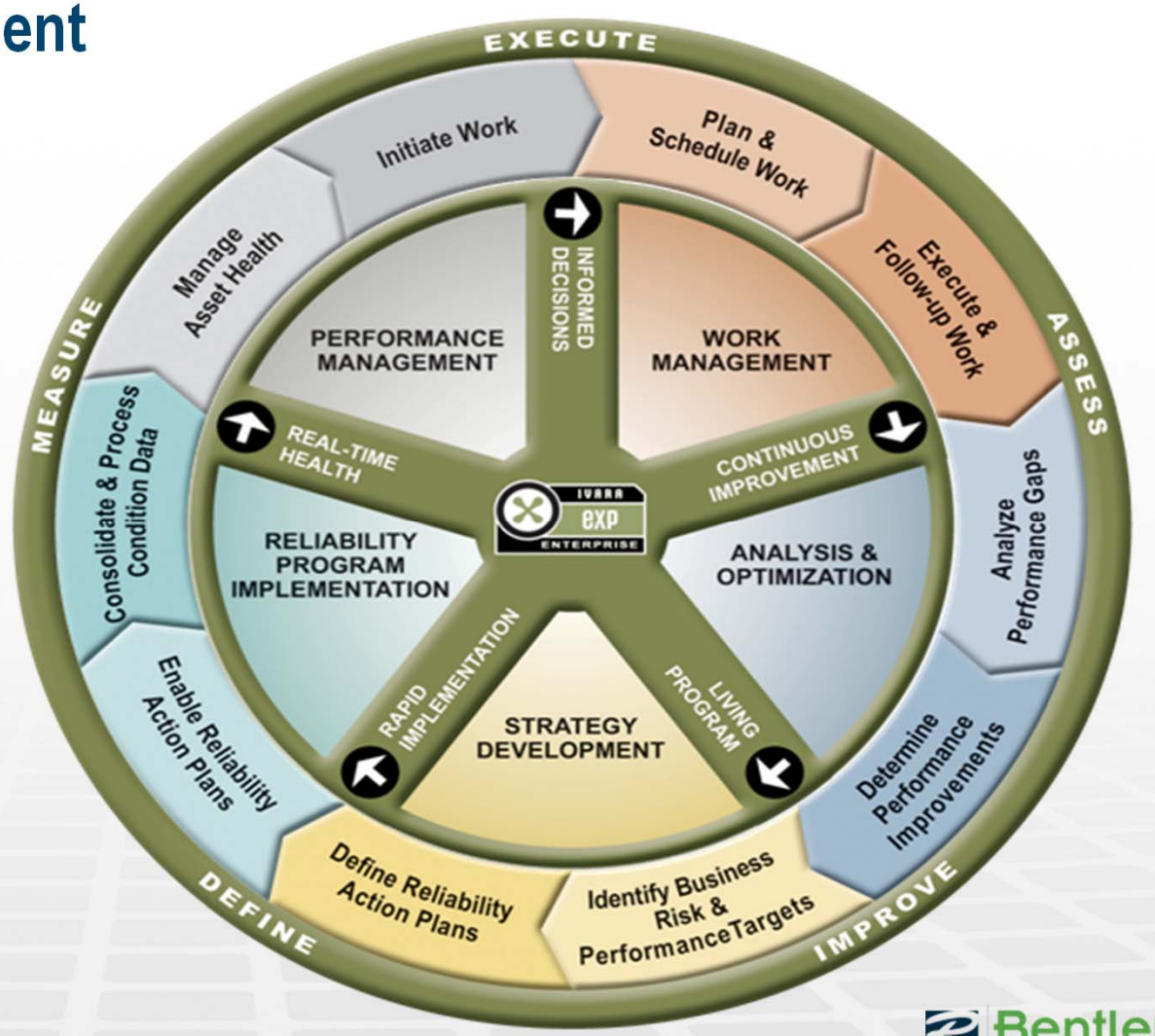
Leveraging an up to date IM to optimize asset performance

Asset Performance Management with Ivara

Bentley Sustaining Infrastructure

Asset Performance Management

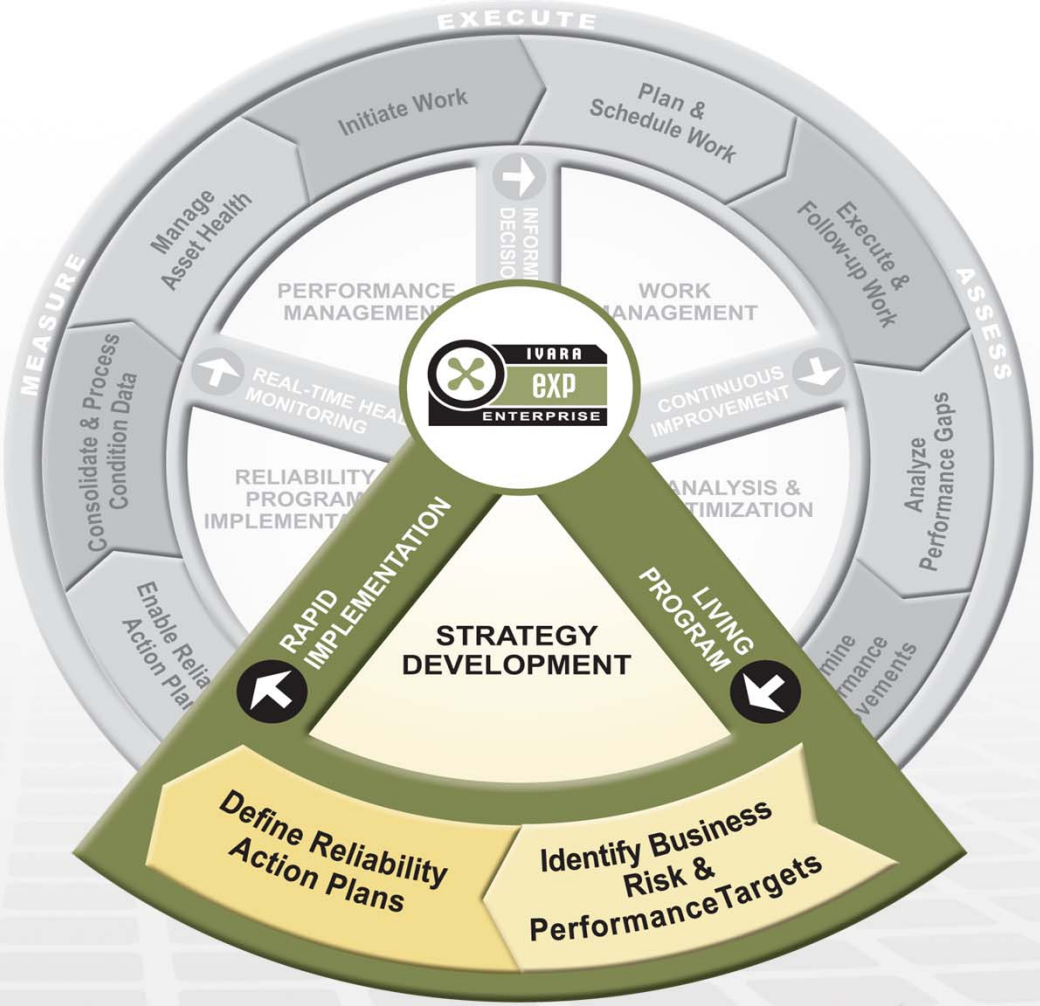
A comprehensive process comprising the stages and activities required to effectively manage physical asset performance



Bentley Sustaining Infrastructure

Strategy Development

- Develop business case
- Objectively quantify operational and non-operational risks
- Analyze assets and manage failure modes
- Develop action plans



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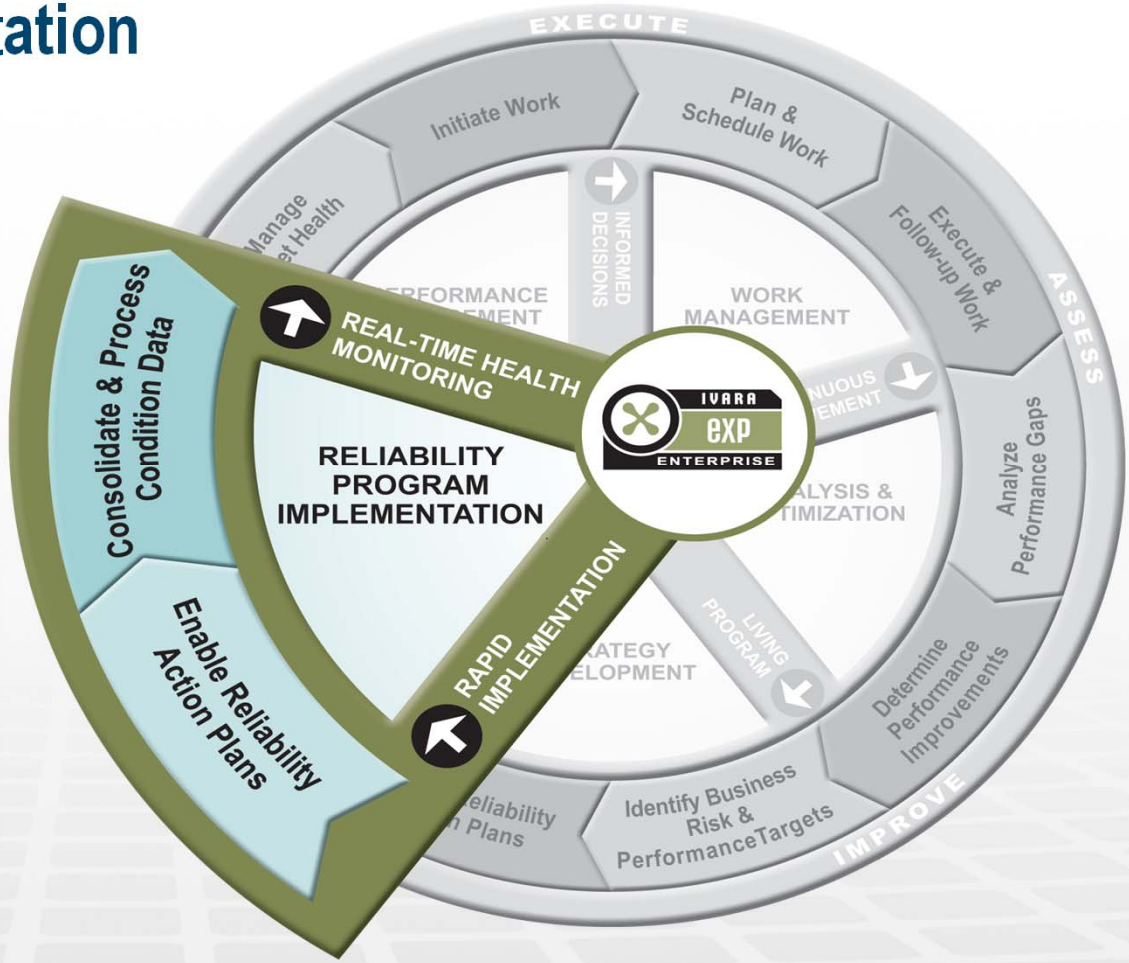
Reliability Program Implementation

- Rapidly implement a sustainable program
- Collect, consolidate and analyze equipment condition data



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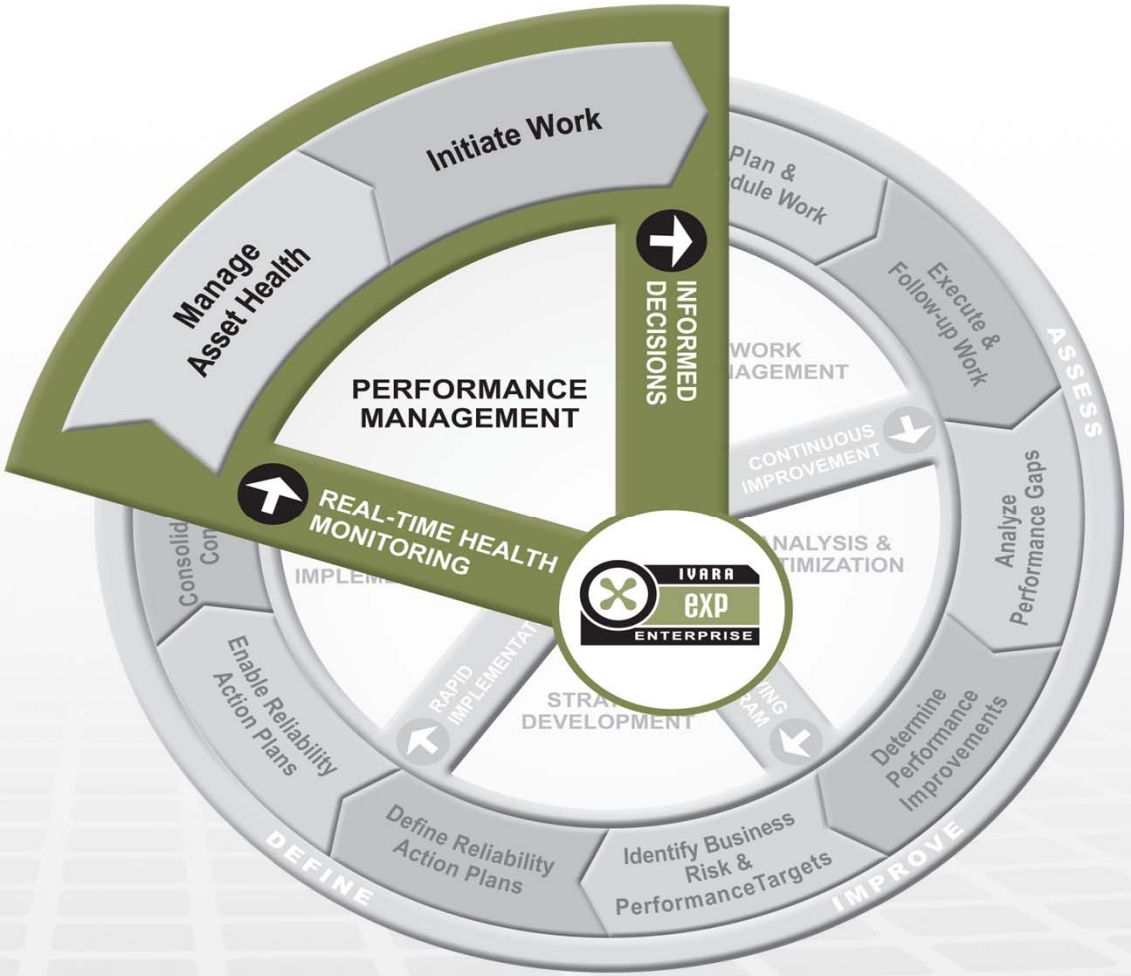
Performance Management

- Control asset and plant performance
- Drive accountability to overall business goals
- Automatically trigger work



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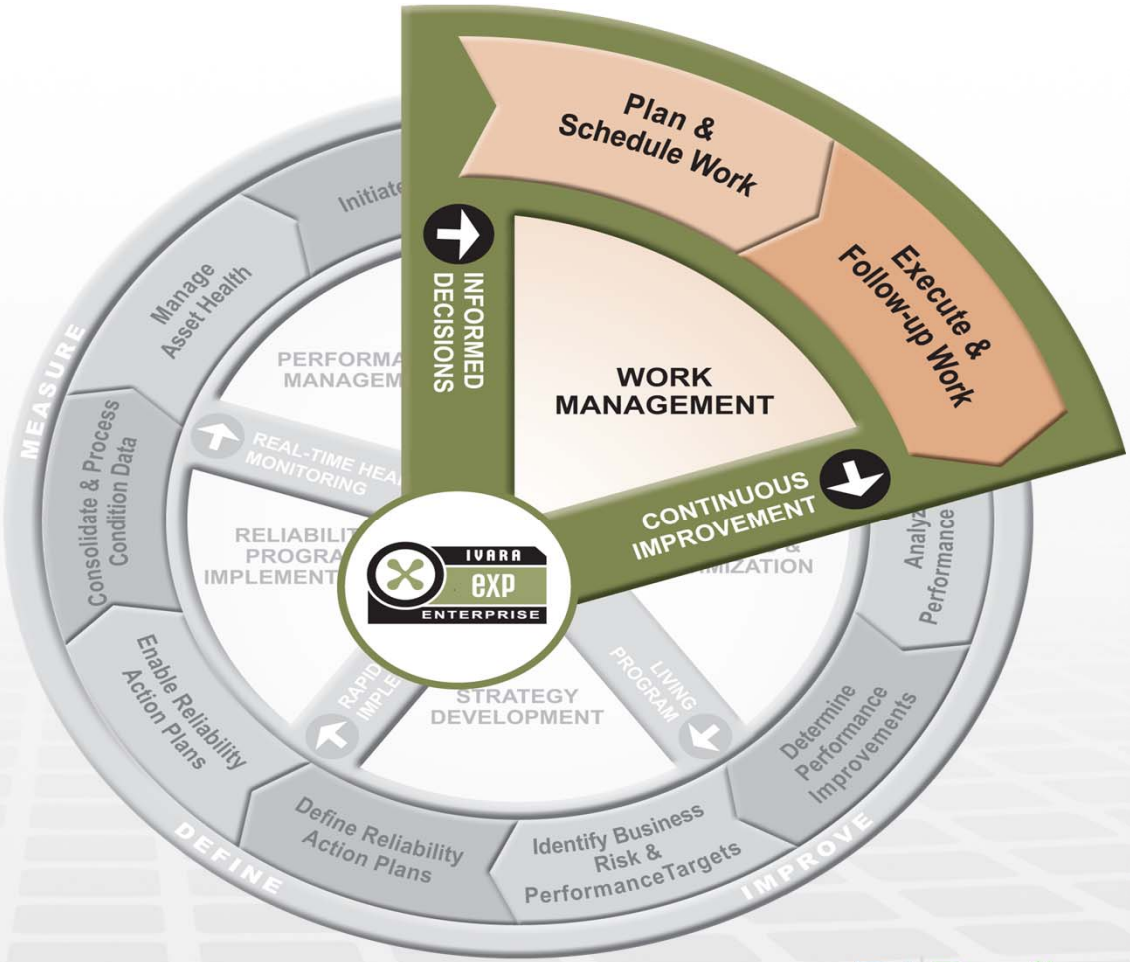
Work Management

- Synchronize with EAM / CMMS
- Pre-planned jobs triggered from EXP are reviewed and scheduled
- Work completion is tied back to EXP



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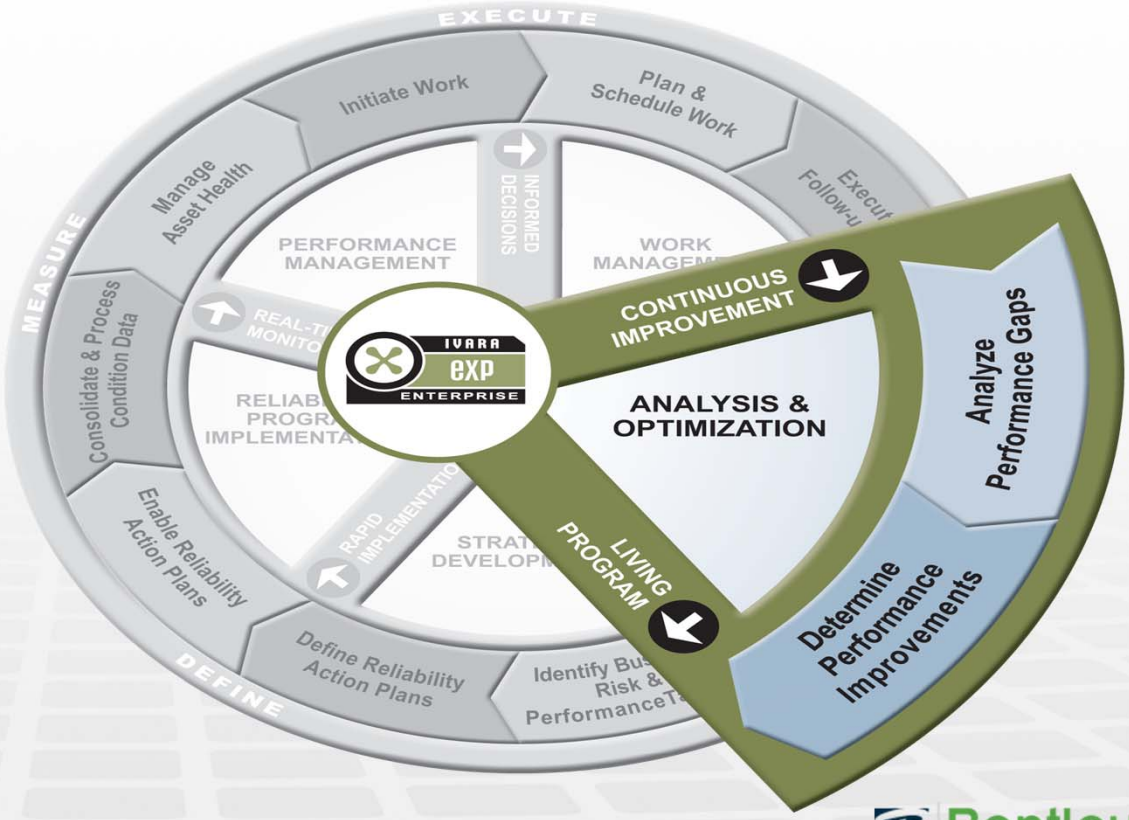
Analysis & Optimization

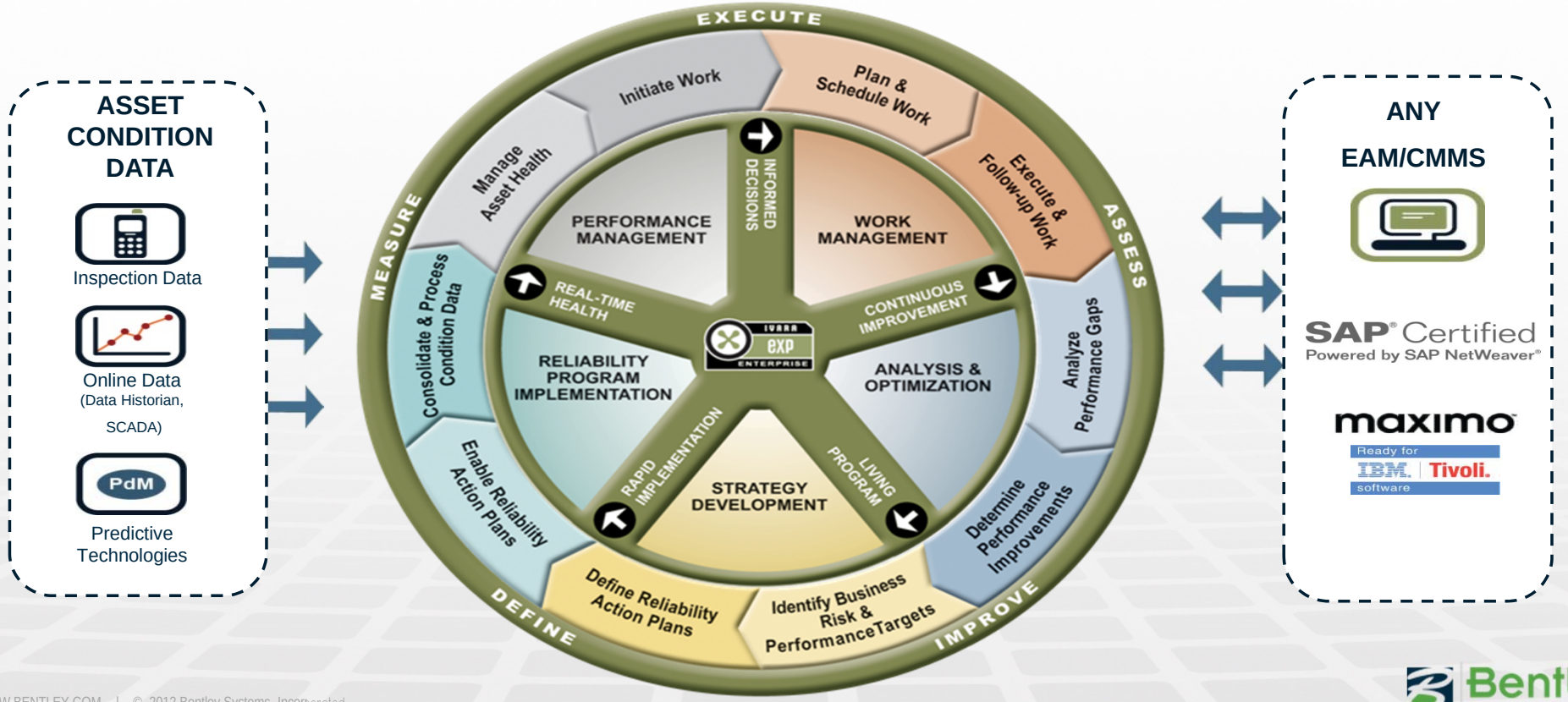
- Analyze and evaluate data
- Identify opportunities for improvement



Bentley Sustaining Infrastructure

Ivara® EXP and Asset Performance

EXP provides technology, processes and practices to maximize Asset Performance



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Bentley Is an ALIM Solutions Provider

Bentley Sustaining Infrastructure


CONSTRUCTION
ConstructSim
ProjectWise
Navigator
ProStructures
MicroStation
WATER & WASTEWATER
WaterGEMS
SewerGEMS
AutoPLANT
OpenPlant
MINING
STAAD
OpenPlant
Raceway and Cable Management
InRoads
Bentley Map
Descartes
GEOPAK
gINT
RAM
BUILDINGS
AECOsim
GenerativeComponents
RAM
ProStructures
speedikon
gINT
3D CITIES
Bentley Map
Geo Web Publisher
Descartes
InRoads
AECOsim
Geospatial Server
NUCLEAR
eB
AutoPIPE
OpenPlant
Raceway and Cable Management
COMMUNICATIONS NETWORKS
Bentley Fiber
Bentley Coax
Inside Plant
ROADS
InRoads
GEOPAK
MX
SUPERLOAD
LEAP
RM
Exor
gINT
BRIDGES
RM
LEAP
SUPERLOAD
GEOPAK
InRoads
gINT
MX
ProStructures
RAIL & TRANSIT NETWORKS
Bentley Rail
Optram
InRoads
MX
RM
GEOPAK
LEAP
gINT
SUBSURFACE UTILITIES
WaterGEMS
SewerGEMS
sisNET
Exor
GEOPAK
gINT
InRoads
MX
POWER PLANTS
AutoPLANT
OpenPlant
AutoPIPE
STAAD
ProStructures
Raceway and Cable Management
AECOsim
RAM
gINT
Descartes
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InRoads
Bentley Map
CAMPUSES
Bentley Map
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Substation
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PROCESS PLANTS
OpenPlant
AutoPLANT
eB
Raceway and Cable Management
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AutoPIPE
ProStructures
STAAD
WIND FARMS
SACS
STAAD
ProStructures
Substation
OFFSHORE
SACS
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Sustaining Infrastructure
Bentley's Solutions
• MicroStation • ProjectWise • AssetWise • Navigator
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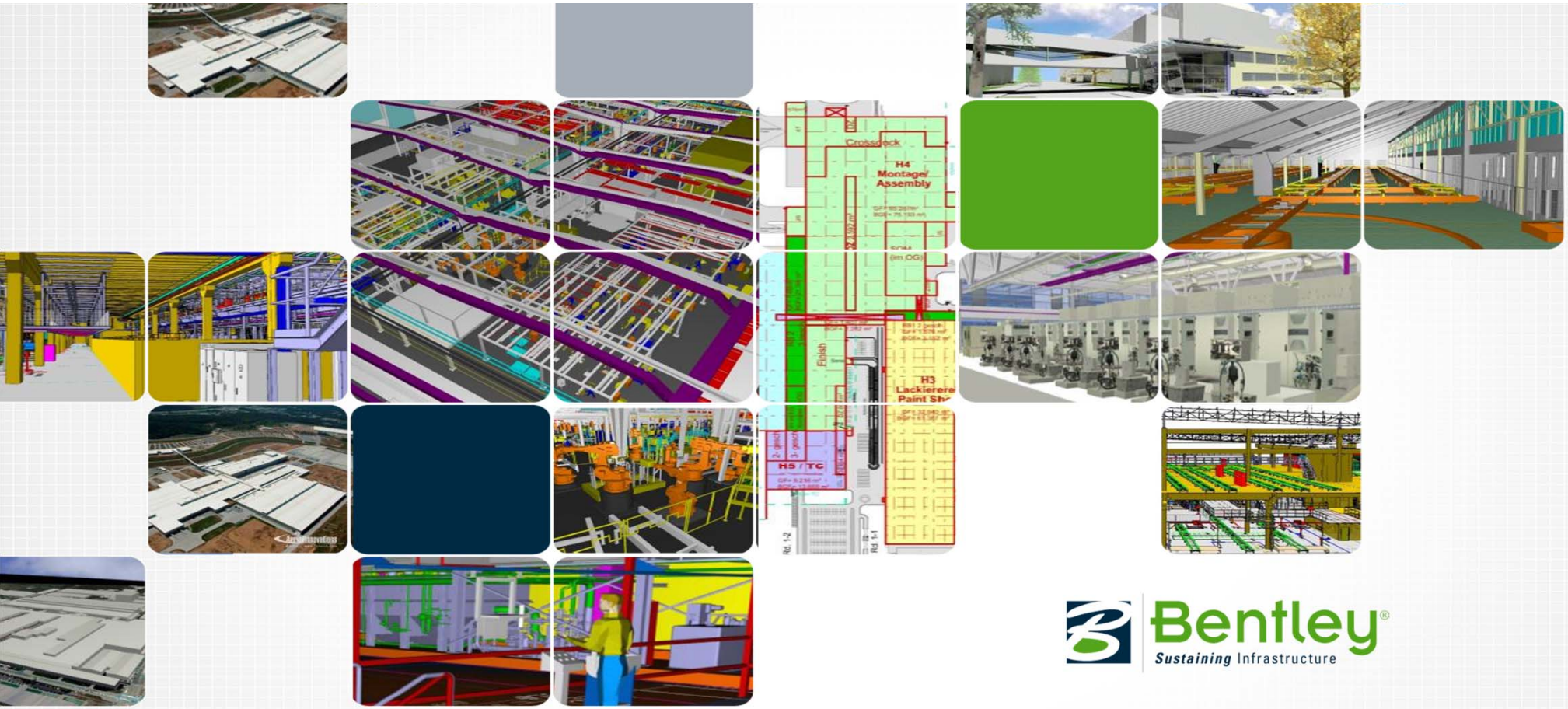

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Questions & Answers

Lutz Bettels, Industry Sales Director Building CEE, Bentley Systems