



# Leveraging Spatial to Address Complex Construction Challenges

Ted Lamboo, Senior Vice President, Bentley Systems



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*.







**CAMPUSES**

- Bentley Map
- AECsim
- Descartes
- RAM
- STAAD
- GEOPAK
- InRoads
- MXROAD
- gINT
- SITEOPS

**MINING**

- MiniCycle
- DownPlant
- AssetWise APM
- Autodesk
- STAAD
- Promis.e
- Bentley Map
- Descartes
- Acute3D
- InRoads
- GEOPAK
- gINT

**WATER & WASTEWATER**

- WaterGEMS
- SewerGEMS
- OpenPlant
- AutoPLANT
- STAAD
- RAM
- OpenPlant Support Engineering gINT
- OpenUtilities
- Subsurface Utilities Engineering

**CITIES**

- Bentley Map
- Descartes
- InRoads
- AECsim
- GEOPAK
- Subsurface Utilities Engineering
- SITEOPS
- Acute3D

**NUCLEAR POWER**

- AutoPIPE
- OpenPlant
- STAAD
- AssetWise APM
- Acute3D

**COMMUNICATIONS NETWORKS**

- OpenUtilities
- Bentley Fiber
- Bentley Core
- Bentley Map Mobile
- Bentley Inside Plant

**BRIDGES**

- RAM Bridge
- LEAP Bridge
- Steel
- InspectTech
- SUPERLOAD
- GEOPAK
- InRoads
- MXROAD
- gINT
- ProStructures

**POWER PLANTS**

- OpenPlant
- AutoPLANT
- AutoPIPE
- Promis.e
- STAAD
- ProStructures
- OpenPlant Support Engineering gINT
- AECsim
- AssetWise APM
- gINT
- Descartes
- Acute3D
- GEOPAK
- InRoads
- Autodesk

**PROCESS PLANTS**

- DownPlant
- AutoPLANT
- AutoPIPE
- OpenPlant Support Engineering
- Promis.e
- ProStructures
- STAAD
- AssetWise APM
- Autodesk
- gINT
- GEOPAK
- InRoads
- SITEOPS
- Acute3D

**SUBSURFACE UTILITIES**

- OpenUtilities
- WaterGEMS
- SewerGEMS
- For
- GEOPAK
- InRoads
- MXROAD
- gINT
- Subsurface Utilities Engineering

**BUILDINGS**

- AECsim
- RAM
- STAAD
- ProStructures
- Handcomp
- speedica
- gINT
- Subsurface Utilities Engineering
- SITEOPS

**CONSTRUCTION**

- Navigator
- Construction
- PW Construction
- Work Package Server
- ProStructures
- Field Supervisor App
- AECsim
- Descartes
- InRoads

**UTILITY NETWORKS**

- OpenUtilities
- Sustein
- WaterGEMS
- SewerGEMS
- STAAD
- Descartes
- AssetWise APM
- Autodesk
- Acute3D

**RAIL & TRANSIT**

- Bentley Rail Track
- Diagram
- GEOPAK
- InRoads
- MXROAD
- RAM Bridge
- LEAP Bridge
- Steel
- gINT
- Promis.e

**WIND FARMS**

- SACS
- MUSES
- MAXSURF
- ProSteel
- OpenPlant
- gINT
- AssetWise APM
- Autodesk
- Acute3D

**OFFSHORE STRUCTURES**

- SACS
- MUSES
- MAXSURF
- AutoPIPE
- ProSteel
- Construction
- OpenPlant
- AssetWise APM
- Acute3D
- Autodesk

**BENTLEY'S PROJECT PLAYBOOKS**

New Products



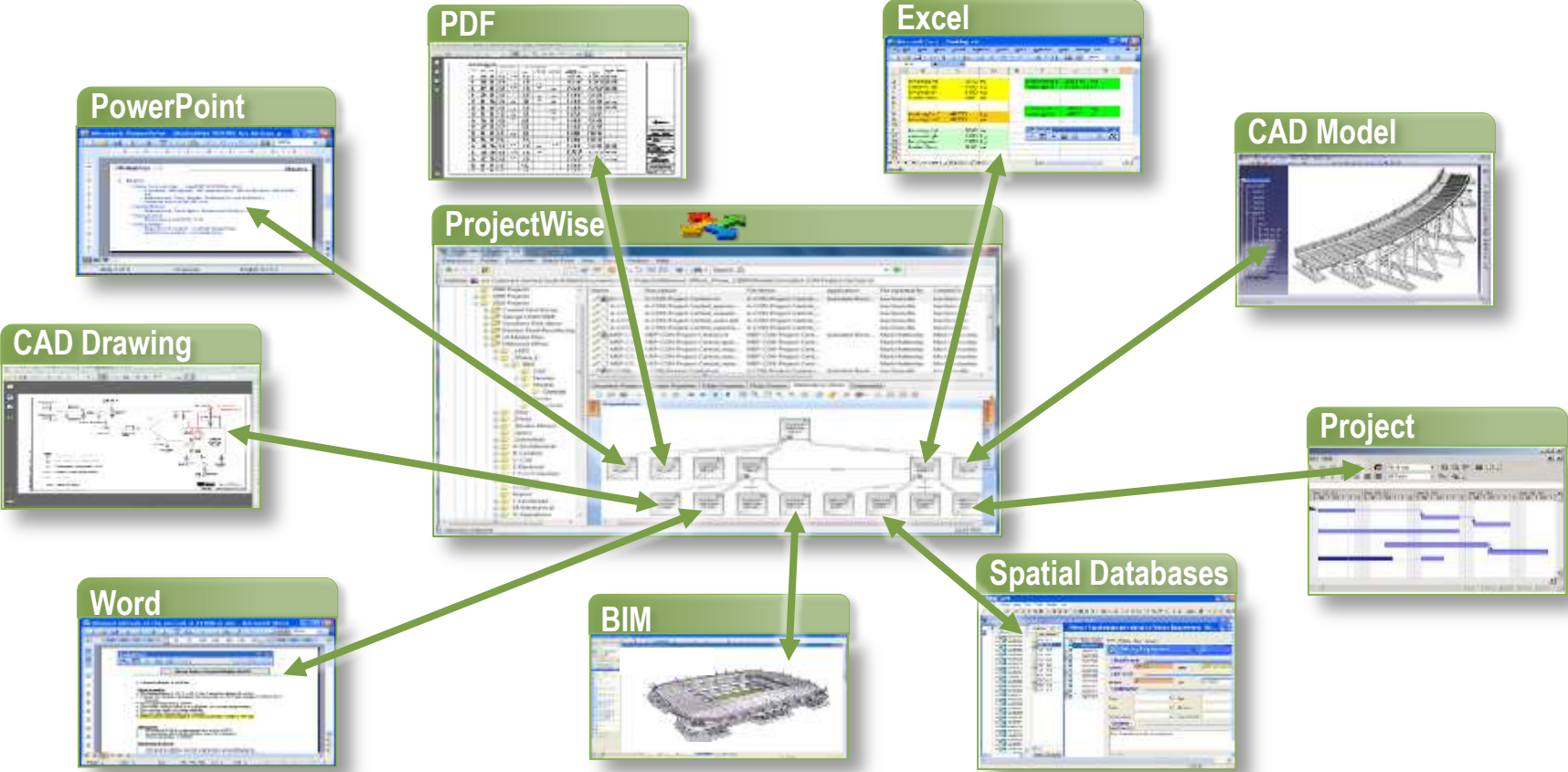
1993 >>> 2003

“A coordinated set of **processes**, supported by technology, that adds value through **creating, managing** and **sharing** the **properties** of an **asset** throughout its **lifecycle**.”

**BIM**

# Unified Data Repository

Sample ProjectWise File Support...  
and a direct connection to Oracle/ESRI Spatial databases



**Reaction**

**Simulation**

**Visualization**

Information Modeling

Analytical Modeling

Design Modeling

Construction Modeling

Asset Performance Modeling

InterCONNECT Edition

Information Mobility

**Design**

**Construction**

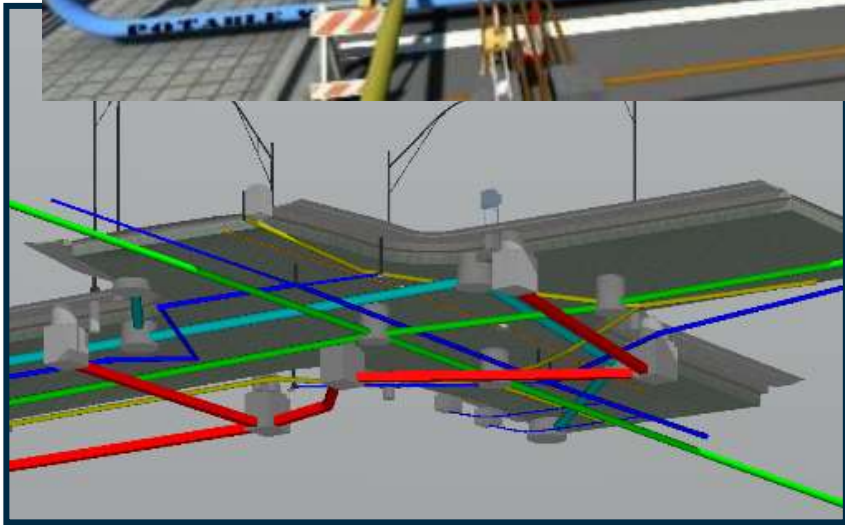
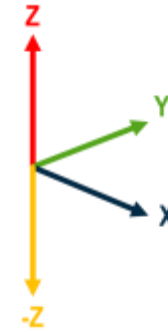
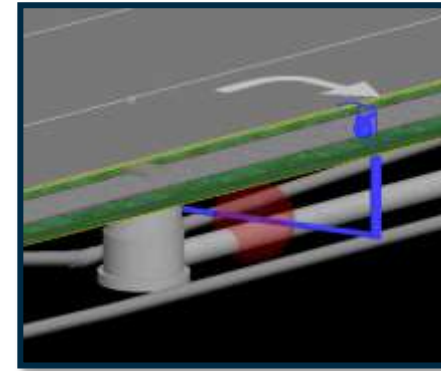
**Operations**







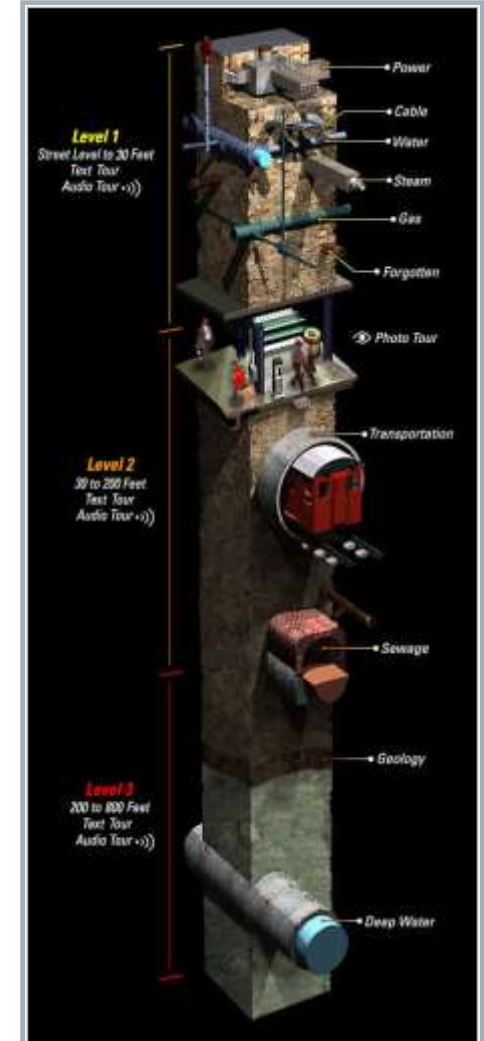
# Subsurface as well



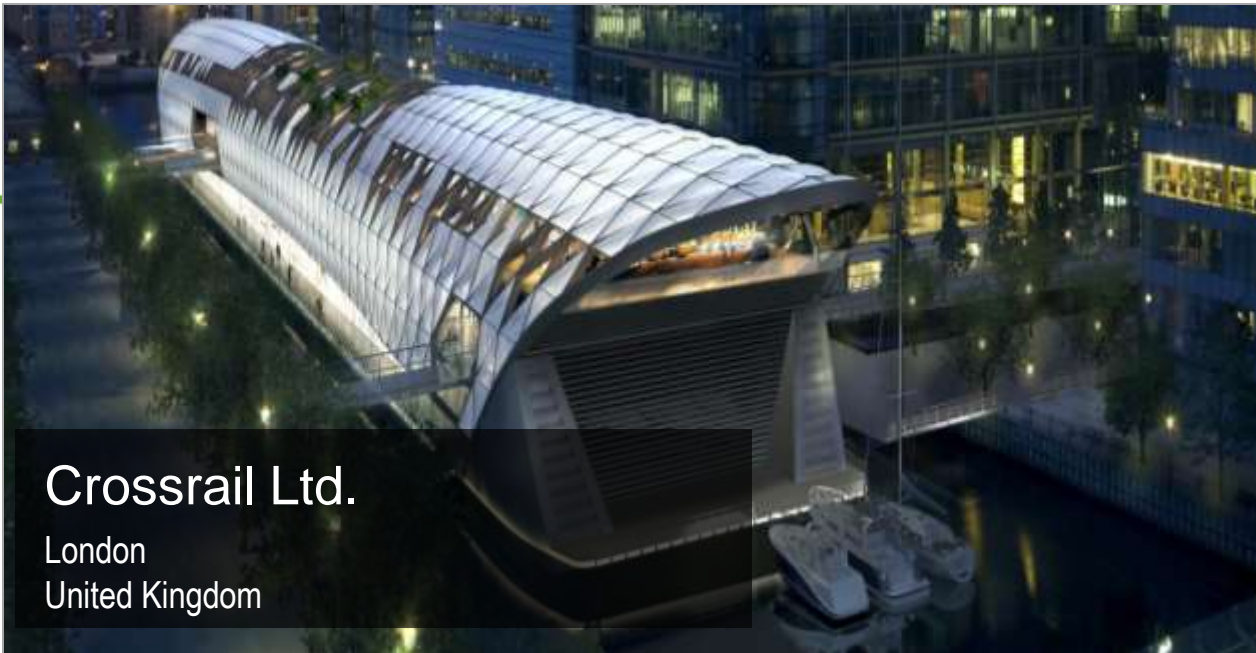


# 3D Spatial for Construction

- Most cities have begun the transition from 2D to 3D
  - Generate realistic visual renderings for the communication of projects to stakeholders
  - Perform more accurate analysis using 3D data
  - Convey complex physical infrastructure plans using photo-realistic images
  - Create 3D data once and reuse for







Crossrail Ltd.

London  
United Kingdom



## Crossrail BIM Strategy: Deliver Best Practice in Lifecycle Information Management

- Provide effective [management of all information assets](#) throughout the lifecycle
- Create an integrated 3D information model, [facilitating multidisciplinary collaboration](#) through design, construction and on to operations and maintenance
- Enable effective handover of 'valuable information' to [form the base of the operational asset management](#) system

*“Exploiting the latest digital technology to ensure that detailed design information was available for the maintenance and operation phases offered a ‘huge’ opportunity to make savings over the whole lifecycle of new infrastructure”. Crossrail is to provide its supply chain with access to the Bentley applications and design tools that it requires them to use.”*

– Andrew Wolstenholme, CEO  
**Crossrail Ltd.**





# Vision... Build Two Railways ...Virtual - Physical

Information & Data Linking



Visualisation  
s

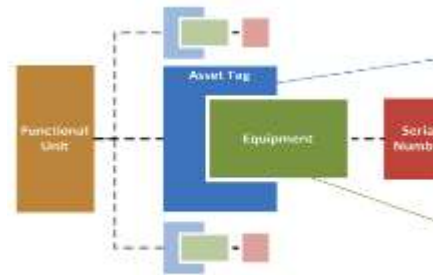
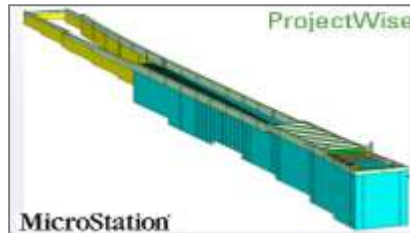
Spatial

3D Models

Assets

Documentatio  
n

Virtual World

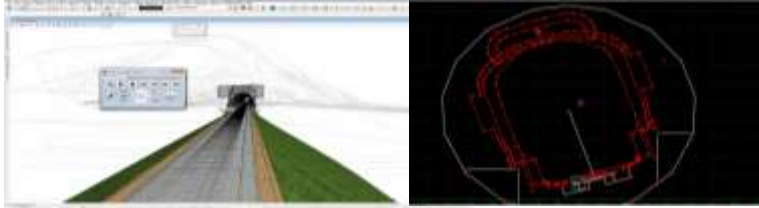


Physical World

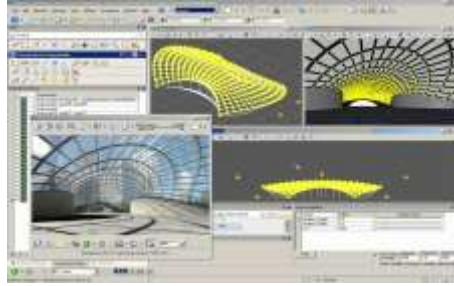




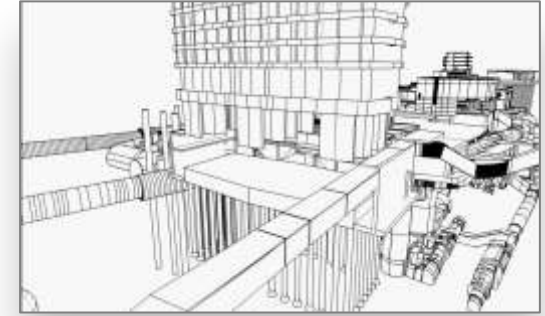
# Integrated BIM Design & Modeling



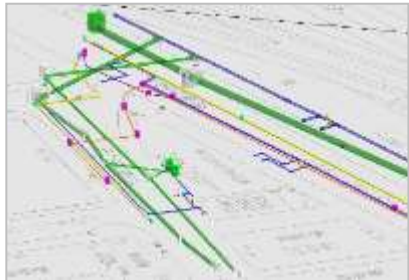
Power Rail Track  
(Track & Tunnel Design)



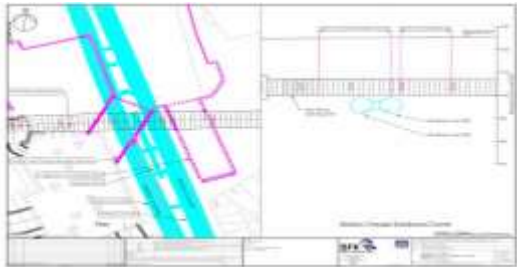
AECOsim Generative Component



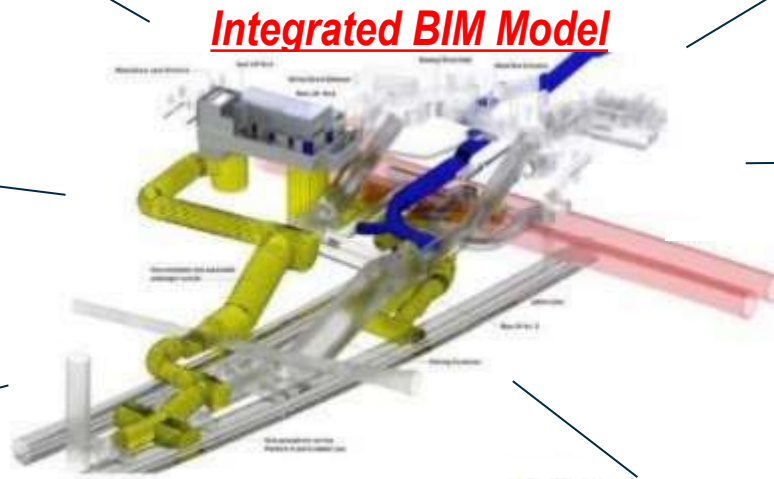
AECOsim Building Designer



Subsurface Utilities Engineering



Bentley Navigator  
(Clash Detection)



***Integrated BIM Model***



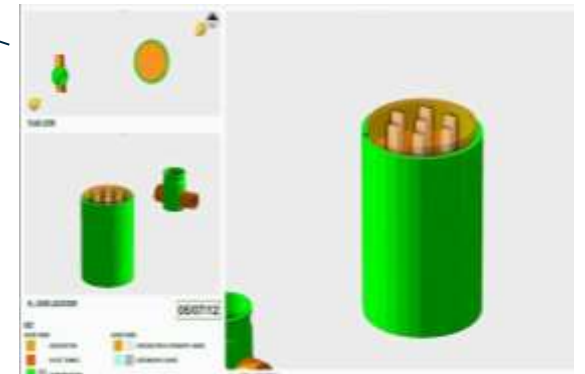
Bentley Substation



OpenBridge Modeler



Quantity Takeoff

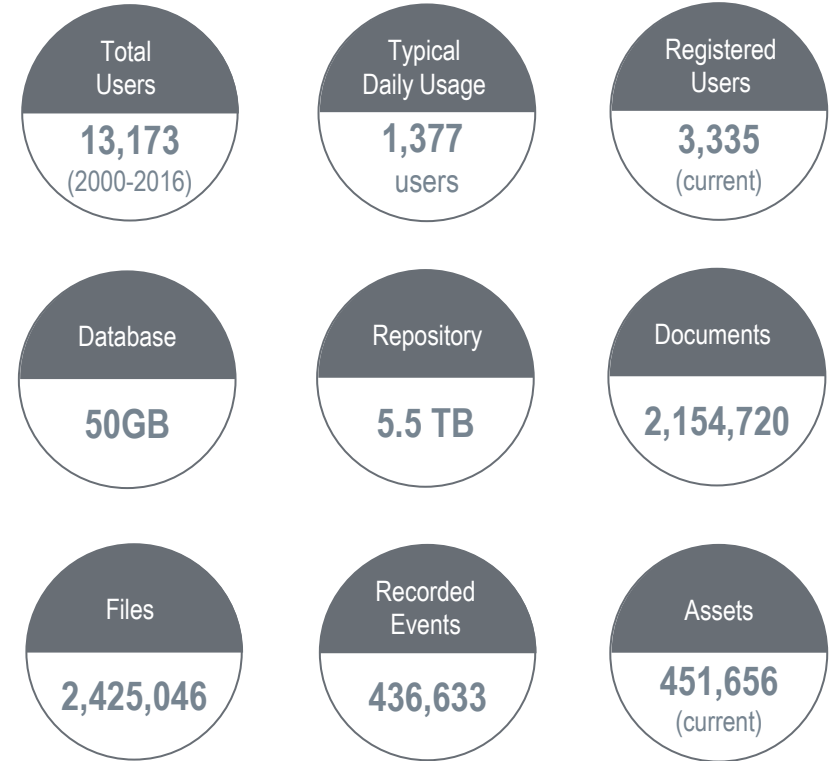


4D - 5D Simulation

# Crossrail

## Outcome (Mid-Project):

- Increased productivity
- Ensures compliance to standards
- Improved cost and time certainty
- Reduced risk





# Construction - BIM used for 4D Simulation



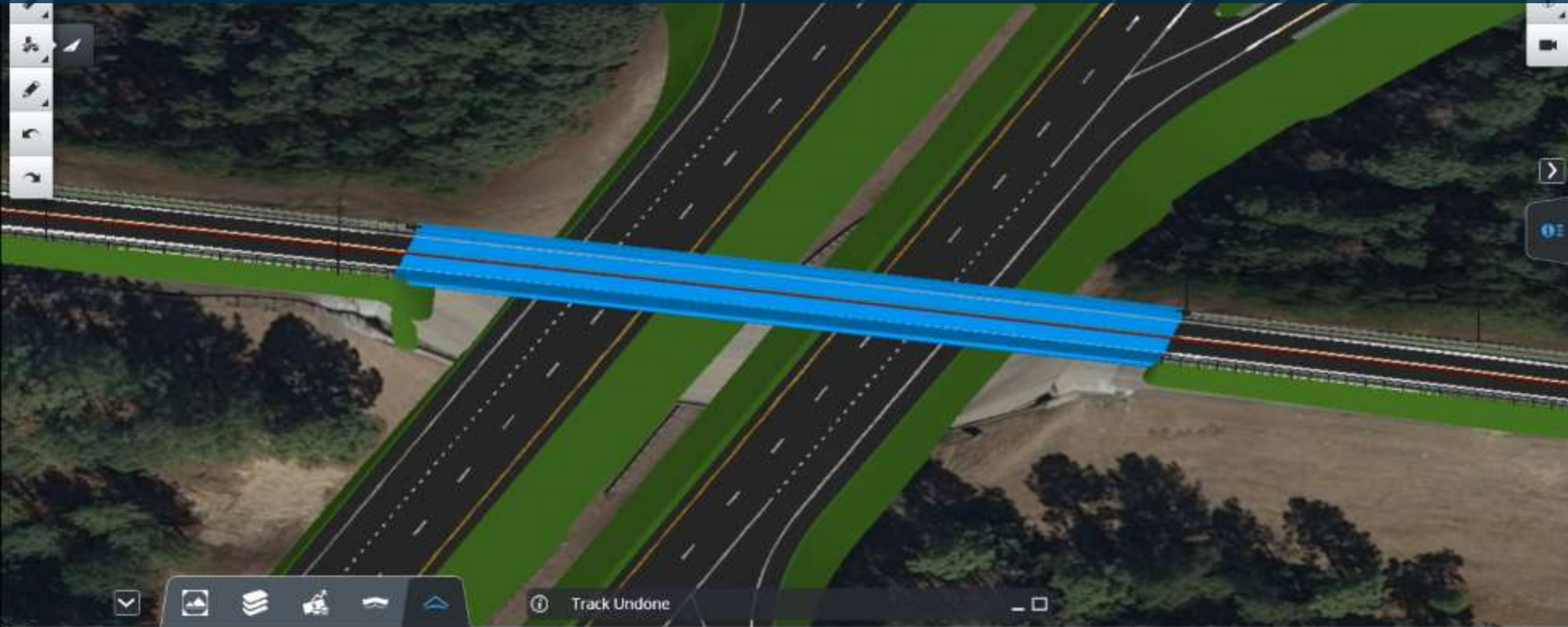


# Create Innovative and Inspiring Designs

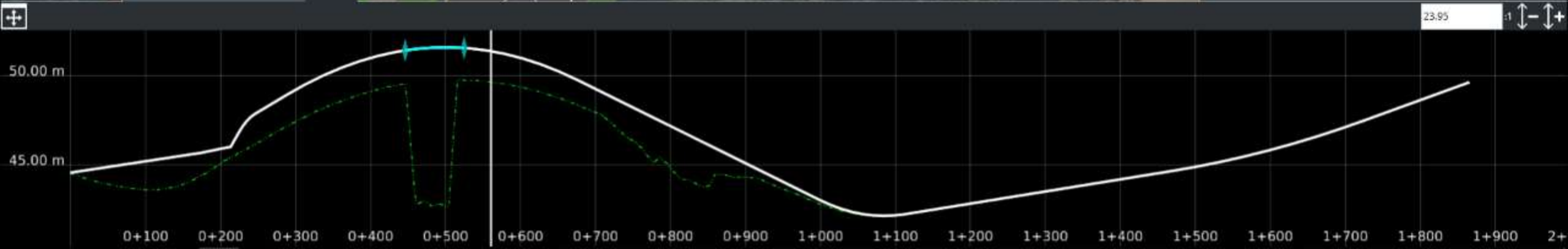




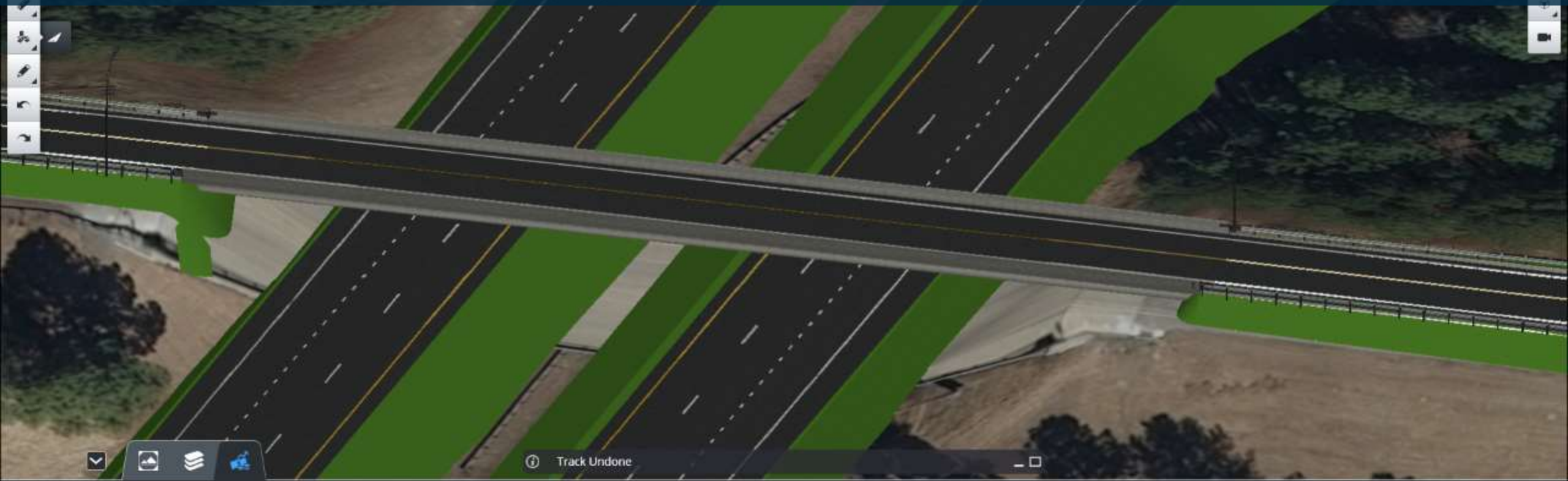
# Rapidly Explore Design Alternatives



Id:	099511628338
Name:	Bridge_3_Default
Alignment Name:	NC Rt 97
Status:	Proposed
Number of Spans:	1
Design Speed:	20 km/h
Bridge Template:	Bridge + Barrier (2 lanes)
Classification:	Urban Principal Arterial (U-PA)
Superstructure Type:	Prestressed Girders
Girder Type:	AASHTO Type III (AASHTO-III)
Number of Girders:	6



# Understand Financial Implications Early



Navigation and tool icons including a dropdown arrow, a camera icon, a stack of layers icon, and a blue globe icon.

Track Undone

Concept estimated cost: \$18,319,784

Category	Cost	Source
Earthwork	\$2,304,753	Design
Pavement	\$10,266,270	Design
Structure	\$500,359	Design
Retaining Wall	\$0	Design
Drainage	\$1,019,510	Allowance
Electrical	\$125,710	Allowance







News Release

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## **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*. At the event presentations, the companies' CEOs presented new cloud-based









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