The Year in INFRASTRUCTURE 2020 Conference

Road and Rail Media Session

*Digital Twins Going Mainstream*
Introductions

Francois Valois  
Vice President, Civil Engineering  
Bentley Systems

Dan Vogen  
Vice President, Transportation Asset Performance  
Bentley Systems

Steve Cockerell  
Industry Marketing Director, Rail and Transit  
Bentley Systems
Watch For This Icon

Advancement Insights
I know you will have questions!
Let’s Talk About…

• Industry Trends
• Latest Innovations
• User Successes
• Sessions you Don’t Want to Miss!
Times Square, New York, USA
COVID-19 an additional driver for Going Digital

- **78%** Working from home will be much more accepted¹
- **59%** Communication / collaboration tools will become more important¹
- **52%** Think ML and AI will become commonplace in the next 5 years²
- **77%** UK construction companies believe digitisation can improve industry productivity²
- **68%** Will accelerate the pace of digital transformation¹

¹ DMEXCO Trend Survey, 2020  
² NBS Construction Technology Report, 2019  
³ Visual Capitalist, 2019
“... now is the time to start reimagining our industry and how organizations can emerge in the next normal from a position of strength.”

- **Short Term**
  - Increased digitization, remote working, reliance on BIM and simulation
  - Digital-twin solutions being developed and used end to end

- **Long Term**
  - Case for proven digital applications become even stronger
  - Increased R&D to speed / automate design / construction
  - Increase in off-site construction and controlled environments
  - Acceleration toward sustainability

Network Rail Wales and Western Region Overcomes Challenges Under Covid-19 Lockdown to Emerge Stronger in Rail and Transits New Normal

Digital Twins helped ensure:
• High quality results ahead of schedule
• Future work and investment in team
• Services above and beyond expectations
Increased demand on firms to meet mandated requirements and standards, and manage liability across the lifecycle.

Reduce Risk and Liability

Increased need to maximize profit margins, deliver more work for available budget, and meet project deadlines.

Reduce Time and Cost

Greater focus on delivering the required level of safety and service to internal team members and external stakeholders.

Improve Safety and Service
Bentley’s Infrastructure Digital Twins

Digital Twins

Cloud

5D+

Data & Insight

Immersive Visualization

Analytics Visibility

Change Synchronization

Reality Modeling

Construction Simulation

Pedestrian Simulation
Bentley’s Infrastructure Digital Twins

Construction & Commissioning
Physical Assets

Operations & Maintenance

Concept & Planning
Digital Twins

Design & Engineering
Digital Twins Going Mainstream

Digital Advancement from Planning to Performance

Also available in the Press Kit

bentley.com/going-digital-roads
bentley.com/going-digital-rail
bentley.com/going-digital-cities
DESIGN
- Mapping and Surveying
- Modeling and Visualization
- Reality Modeling
- Bridge Design
- Building Design
- Communications Network Engineering
- Communication Tower Design
- Electrical Design
- Geotechnical Engineering
- Offshore Structure Design
- Plant Design
- Rail Design
- Road Design
- Site Design
- Steel and Concrete Design and Detailing
- Substation Design
- Tunnel Design
- Utility Network Design

SIMULATE
- Bridge Analysis
- Building Energy Analysis
- District Heating Analysis
- Electrical Network Analysis
- Flood Analysis
- Gas Network Pressure Analysis
- Geotechnical Analysis
- Hydraulics Analysis
- Hydrology Analysis
- Mobility Simulation and Analysis
- Offshore Structure Analysis
- Pedestrian Simulation and Analysis
- Pipe Stress and Vessel Analysis
- Structural Analysis
- Transportation and Land Use Analysis

CONSTRUCT
- 4D Modeling and Scheduling
- Advanced Work Packaging
- Construction Project Management
- Cost Management
- Field Management

OPERATE
- Asset Reliability
- Bridge Load Rating and Analysis
- City Digital Twin
- Electric Network Digital Twin
- Geotechnical Information Management
- Machine Learning and Predictive Analytics
- Process Plant Digital Twin
- Rail Assurance
- Rail Network Management and Analysis
- Road Network Management and Analysis
- Routing and Permitting
- Water Infrastructure Digital Twins

Multi-discipline Collaboration  •  Contractual Deliverables Management  •  Project Coordination  •  Project Insights  •  Asset Lifecycle Information Management

INFRASCTURE DIGITAL TWINS

Capital Project Management
Bentley in Transportation

**Road Design**
- 44 US DOT’s
- 29 China Provinces
- 37 European Countries
- ½ Canadian Provinces
- FHWA and USACE

**Rail Design**
- 36 Rail O/O’s
- 21 European Countries
- 3 South East Asian Countries
- Fastest, Longest, Oldest, and First
- Network Rail, TfL, Crossrail and HS2

**Bridge Design and Analysis**
- 35 US DOT’s
- 20 Chinese Provinces
- 60K Bridges in last 20 years
- 20 of 36 Indian States and Union Territories
- FHWA and USACE

**Geotechnical Engineering and Analysis**
- 46 USA DoT’s
- ½ Canadian Provinces
- HS2 and Crossrail

**Road and Rail Network Management and Analysis**
- 30 USA DoT’s
- Highways England + all areas
- Network Rail, TfL, Crossrail and HS2
- 17 Global users across all classes

**Mobility Simulation and Analysis**
- 6 of 6 Australian States
- ½ ASEAN Member Countries
- 6 of 10 India’s most populated urban areas
- 100% Areas in Greater China
- 26 of 50 Largest metro areas in US
- 7 of 13 Subways / Metros operating in India

**Multidiscipline Collaboration**
- 100+ Rail O/O’s
- 100+ Road O/O’s
Bentley in Transportation

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Road and Rail Network Management and Analysis
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- England + all areas
- 17 Global users across all classes
- SMRT, NY MTA, Network Rail and TfL

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- 100% Areas in Greater China
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Multidiscipline Collaboration
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  - 46 USA DoT's
  - ½ Canadian Provinces
  - HS2 and Crossrail

- **Multidiscipline Collaboration**
  - 100+ Rail O/O's
  - 100+ Road O/O's

- **Additional Stats**
  - 204K Bridges in last 20 years
  - 20 of 36 Indian States and Union Territories
  - Fastest, Longest, Oldest, and First
  - Network Rail, TfL, Crossrail and HS2
  - 6 of 6 Australian States
  - ½ ASEAN Member Countries
  - 6 of 10 India’s most populated urban areas
  - 100% Areas in Greater China
  - 26 of 50 Largest metro areas in US
  - 7 of 13 Subways / Metros operating in India
## ROAD AND RAIL

### DESIGN
- Mapping and Surveying
- Modeling and Visualization
- Reality Modeling
- Bridge Design
- Building Design
- Electrical Design
- Geotechnical Engineering

**Rail Design**
- Site Design
- Steel and Concrete Design and Detailing
- Substation Design
- Tunnel Design

### SIMULATE
- Bridge Analysis
- Building Energy Analysis
- Flood Analysis
- Geotechnical Analysis
- Hydraulics Analysis
- Hydrology Analysis
- Mobility Simulation and Analysis
- Pedestrian Simulation and Analysis
- Structural Analysis
- Transportation and Land Use Analysis

### CONSTRUCT
- 4D Modeling and Scheduling
- Advanced Work Packaging
- Construction Project Management
- Cost Management
- Field Management

### OPERATE
- Asset Reliability
- Bridge Load Rating and Analysis
- Geotechnical Information Management
- Machine Learning and Predictive Analytics
- Rail Assurance
- Rail Network Management and Analysis
- Road Network Management and Analysis
- Routing and Permitting

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- Multi-discipline Collaboration
- Contractual Deliverables Management
- Project Coordination
- Project Insights
- Capital Project Management
- Asset Lifecycle Information Management

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**INFRASTRUCTURE DIGITAL TWINS**
• View civil quantities directly in iTwin Design Review
• Always current and accessible to all
• Run report any time and view historical changes
• One less deliverable to print
NYS Department of Transportation Delivers First Model-based Contracting 3D Project in New York State DOT History

Digital Twin
- First Model-based Contracting 3D Project in New York State DOT History
- Saving 15% in design time
- Restoring a critical bridge to the community
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- Multi-discipline Collaboration
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**INFRASTRUCTURE DIGITAL TWINS**
OpenBridge

- Combines modeling, design, and analysis in one application
- 3D Rebar Modeling
- Bridge beyond BIM to digital Twin
- Global adoption accelerating
3D Modeling Helps Arup Improve Quality and Efficiency of Bridge Design as Part of a New City Center Development Project in Dublin, Ireland

Digital Twin
- Modeling process shortened by 50%
- ROI in design by 25%
- Time to plot drawings reduced from 1 day to 1 hour
PT. Waskita Karya (Persero) Tbk is Transforming Project Delivery in Indonesia on Phase II of Jakarta’s Manggarai Station Revitalization

Manggarai Station Revitalization

- New bridge expanding platform capacity to 2 levels
- Tight design review and construction schedule
- IDR 1 billion per month in additional time/cost avoided
- Digital twin and workflows to optimize construction schedule
- ProjectWise 365 key to project delivery modernization

"...there is no better way to point those options out than visualizing it with the digital twin."  
Marsa Achadian Tyarpratama  
BIM Junior Expert  
PT. Waskita Karya Tbk
## ROAD AND RAIL

### DESIGN
- Mapping and Surveying
- Modeling and Visualization
- Reality Modeling
- Bridge Design
- Building Design
- Electrical Design
- **Geotechnical Engineering**
  - Rail Design
  - Road Design
  - Site Design
  - Steel and Concrete Design and Detailing
  - Substation Design
  - Tunnel Design

### SIMULATE
- Bridge Analysis
- Building Energy Analysis
- Flood Analysis
  - **Geotechnical Analysis**
    - Hydraulics Analysis
    - Hydrology Analysis
    - Mobility Simulation and Analysis
    - Pedestrian Simulation and Analysis
    - Structural Analysis
    - Transportation and Land Use Analysis

### CONSTRUCT
- 4D Modeling and Scheduling
- Advanced Work Packaging
- Construction Project Management
- Cost Management
- Field Management

### OPERATE
- Asset Reliability
- Bridge Load Rating and Analysis
  - **Geotechnical Information Management**
    - Machine Learning and Predictive Analytics
    - Rail Assurance
    - Rail Network Management and Analysis
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    - Routing and Permitting

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**Multi-discipline Collaboration** • **Contractual Deliverables Management** • **Project Coordination** • **Project Insights**

**Capital Project Management**

**INFRASTRUCTURE DIGITAL TWINS**
OpenGround Cloud

- Centralize cloud based geotechnical information management
- Complementing gINT and Keynetix products
- Cover complete geotechnical information lifecycle
- Integrated with world’s leading geotechnical analysis tool (PLAXIS)
- Integrated with Bentley civil engineering design tools (OpenRoads, OpenRail, OpenBridge and OpenSite)
POWERCHINA Huadong Engineering Corporation Limited Uses BIM to Provide the Foundation of a Digital Twin and Transform the Ancient Chinese City of Shaoxing

- Design and construction of New Urban Rail Transit Line
- Limited space, complex site conditions, multiple disciplines
- 800 hours of field collection time and RMB 3 million saved
- Digital workflows doubled design productivity
# ROAD AND RAIL

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**INFRASTRUCTURE DIGITAL TWINS**
OpenBuildings Station Designer and LEGION Simulator

• Purpose built for rail station and platform design
• Pedestrian modeling, analysis and simulation through entire lifecycle of asset
• New social distancing enhancements to deliver safe and efficient rail stations
Atkins on Social Distancing

- Leveraging Bentley OpenBuildings Station Designer and LEGION Simulator to reopen facilities around the world

Burj Khalifa / Dubai Mall Station
United Arab Emirates

We provided pedestrian simulation modelling services to assess the redesign of a pedestrian footbridge connecting for new developments at the Burj Khalifa Station.
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**Capital Project Management**

**INFRASTRUCTURE DIGITAL TWINS**
OpenRail
Overhead Line Designer

• First comprehensive contact line design modeling application for rail electrification

• Deliver BIM compatible models and support creation of digital twins

• Benefits: ensure design standards, automate plan production, dynamic change management, meet BIM requirements
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**Multi-discipline Collaboration**
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**Infrastructure Digital Twins**
Multidiscipline Collaboration
ProjectWise 365

- Major product update
- New task-based interface specific to design workflows
- Comprehensive 2D/3D design review workflows
- Stoplight dashboards keep participants on schedule
Project Insights
ProjectWise 365

- New capabilities
- Engineering work status versus schedule
- Portfolio and program insights
- Proactive risk management and best practices monitoring
**Bentley Has Your Back**
Support for Working Remotely Wherever You Are

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**Multidiscipline Collaboration**
**ProjectWise 365**

- Announcement – Continuation of the *Bentley Has Your Back* program
- No cost, risk-free introductory offer
- Actively helping firms adapt to hyper-distributed teams
- Program extended into 2021
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4D Construction Modeling and Scheduling

SYNCHRO 4D

- New capabilities
- Work area modeling with model-based QTO
- Time-based issues linked to construction sequence
- Enhanced visualization with LumenRT integration
- iTwin-enabled cloud collaboration in real time
Construction Cost Management
SYNCHRO Cost

- Cloud-based bid management
- Centralized view of vendor contracts and compliance
- Streamlined sourcing and proactive risk management
Acquisition NoteVault

• Voice-based field automation for construction management
• Extends SYNCHRO and the value of digital twins across construction
• More effective management of cost, schedule, and risk
Construction Field Management
SYNCHRO Field

- **New** field mobility capabilities
- Voice-based automation for field reporting (NoteVault)
- 4D simulation and 3D models in the field
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- Multi-discipline Collaboration
- Contractual Deliverables Management
- Project Coordination
- Project Insights
- Asset Lifecycle Information Management
Acquisition GroupBC

• UK Leader in cloud services for Capital Project Management
• Opportunity to federate CDEs for project, engineering, and construction management
• Advances collaborative BIM via “evergreen” digital twins for the asset lifecycle
Capital Project Management

Business Collaborator

- **New** product – Business Collaborator Projects
  - Turnkey ISO compliance
  - Ideal for small and medium sized projects
- **New** capabilities
  - iTwin integration
  - ProjectWise integration
Project Delivery Industry Breakout

Introductions

Dustin Parkman  
Vice President, Project Delivery  
Bentley Systems

Ken Adamson  
Vice President, Design Integration  
Bentley Systems

Victor Alvarez  
Director, Marketing Programs, Project Delivery  
Bentley Systems
**ROAD AND RAIL**

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**Multi-discipline Collaboration**  •  **Contractual Deliverables Management**  •  **Project Coordination**  •  **Project Insights**  •  **Asset Lifecycle Information Management**  •  **Capital Project Management**

**INFRASTRUCTURE DIGITAL TWINS**
AssetWise
Digital Twin Services
U.S. Bridge Compliance

- Meets new SNBI bridge inspection standards
- Intuitive mobile app for efficient inspections
- No-cost for new SNBI specification upgrade
- Fast implementation with configurable work processes
- COTS solution available now!
AssetWise Digital Twin Services

Immersive Bridge Inspections

- Leverages reality models within digital twins
- Perform ‘inspections’ in the safety of your office
- Augmented reality with Microsoft HoloLens for annotation and change
Maryland State Highway Administration uses AssetWise to create Infrastructure Insight Portal, improving decision making and preserving transportation infrastructure assets.
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Multi-discipline Collaboration  •  Contractual Deliverables Management  •  Project Coordination  •  Project Insights  •  Capital Project Management  •  Asset Lifecycle Information Management
AssetWise Digital Twin Services

The power of a rapidly deployed rail analytics solution

- Out-of-the-box solution for small to medium owner/operators
- Leverages advanced AI technology
- Fully configurable linear analytics with minimal implementation time and cost
SMRT Trains Ltd

- A holistic view to optimize maintenance
- Achieved 1 Million MKBF across rail lines
- Better understanding and more accurate decisions
- Improved insights for long-term maintenance planning
### DESIGN
- Mapping and Surveying
- Modeling and Visualization
- Reality Modeling
- Bridge Design
- Building Design
- Electrical Design
- Geotechnical Engineering
- Rail Design
- Road Design
- Site Design
- Steel and Concrete Design and Detailing
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### SIMULATE
- Bridge Analysis
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- Hydrology Analysis
- Mobility Simulation and Analysis
- Pedestrian Simulation and Analysis
- Structural Analysis
- Transportation and Land Use Analysis

### CONSTRUCT
- 4D Modeling and Scheduling
- Advanced Work Packaging
- Construction Project Management
- Cost Management
- Field Management

### OPERATE
- Asset Reliability
- Bridge Load Rating and Analysis
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### Multi-discipline Collaboration
- Contractual Deliverables Management
- Project Coordination
- Project Insights

### Capital Project Management

### INFRASTRUCUTRE DIGITAL TWINS
Key Reference Materials

• Advancement Insights
  • Network Rail – Overcoming COVID-19
  • NYS Department of Transportation – Model-based digital twin
  • Arup – Dublin city centre bridge
  • PT. Waskita Karya (Persero) Tbk - Manggarai Station revitalization
  • POWERCHINA Huadong Engineering Corporation – Shaoxing Rail Transit Line
  • Maryland State Highway Administration – Infrastructure Insight Portal
Key Reference Materials

• Product Advancement Group Updates
  • Design Integration
  • Project Delivery
  • Asset and Network Performance
  • iTwin Platform
  • Digital Cities

Find this and much more in the YII Virtual Press Kit at: yii.bentley.com/press
Key Takeaways

• Think Big, Prove Small, Scale Fast

• Digital twins:
  • Driving Design
  • Enabling Construction
  • Improving Performance

• Grasp the opportunity Big Data and IoT present

Find this and much more in the YII Virtual Press Kit at: xx
YII Awards Finalists

*Roads and Highways*

- **Oosterweelverbinding Antwerpen**
  Sweco Nederland B.V.

- **Mumbai Coastal Road Project (South) Package II**
  SAI-SYSTRA Group

- **BIM Technology Application on Chengdu-Yibin Expressway**
  Sichuan Road & Bridge (Group) Co., Ltd.
YII Awards Finalists

*Bridge*

- Cherrywood Grand Parade Bridge
  Arup

- Chishui River Bridge
  Sichuan Road & Bridge (Group) Co., Ltd

- Digital Design and Construction of Taihong Yangtze River Bridge
  Chongqing Communications Planning, Survey & Design Institute Co. Ltd., Guizhou Communications Construction Construction Group Co. Ltd., Guizhou Bridge Construction Group Co. Ltd.
YII Awards Finalists

**Rail and Transit**

- Innovative Application of Digital Engineering Technology in Shaoxing Rail and Transit Construction
  POWERCHINA Huadong Engineering Corporation Limited

- Bristol Area Signalling Renewals Enhancements Driver Route Learning using MicroStation
  Network Rail Wales and Western Region

- Application of BIM in the Construction of Power and Electrification Project of Beijing-Zhangjiakou High-speed Railway
  China Railway Electrification Engineering Group Co. Ltd., China Railway Engineering Consulting Group Co. Ltd., China Academy of Railway Sciences Corp. Ltd.
YII Awards Finalists

*Road and Rail Asset Performance*

- **Collaborative Information System Implementation - Whole Lifecycle Common Data Environment**
  Roads & Transport Authority

- **Predictive Decision Support System (PDSS)**
  SMRT Trains Ltd

- **A pattern of safety - Maryland One (SUPERLOAD) Violation Tracking & Asset Insight**
  Maryland State Highway Administration
THANK YOU!