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Digital Based Workflows for Construction

Transforming the Way the World Works

Who am I



- Advanced Solutions Manager 3D, Trimble Geospatial EMEA
- Trimble Rotational Program (Mixed Reality, Tekla, Energy, Geospatial)
- PhD in Engineering, University of Cambridge
- Visiting scholar, Georgia Institute of Technology
- MSc in Engineering Project Management, ATh
- BEng-MSc in Civil Engineering, ATh



Agenda

- 01** Digital Construction Overview
- 02** Digital Based Workflows
- 03** Use Cases
- 04** Q/A



01

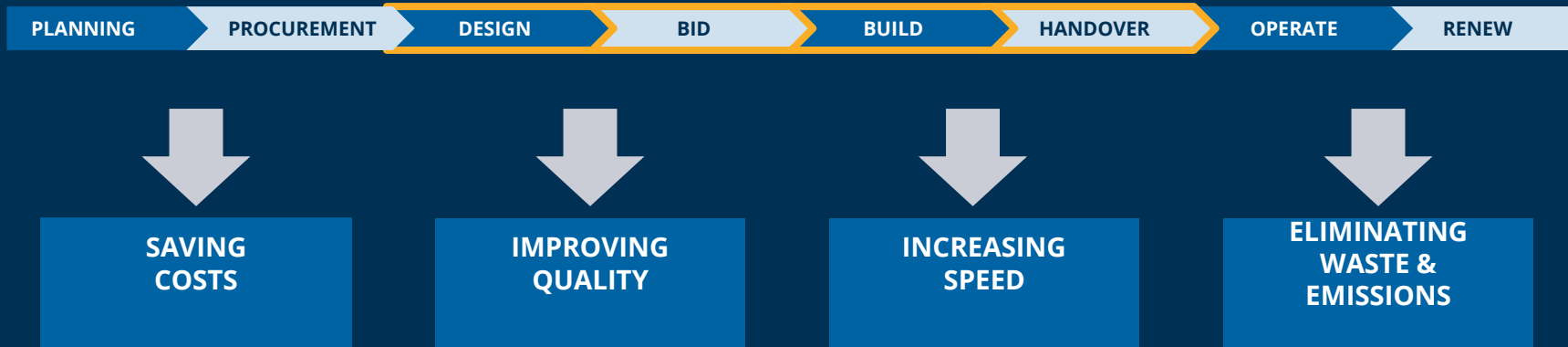
Digital Construction

Overview



What is Digital Construction?

“Digital construction is defined as utilizing digital technologies to construct more efficiently with higher quality.”*



Why Digital Construction?

Digital technologies provide answers to some key industry challenges surrounding complexity, labor, productivity, sustainability and profitability

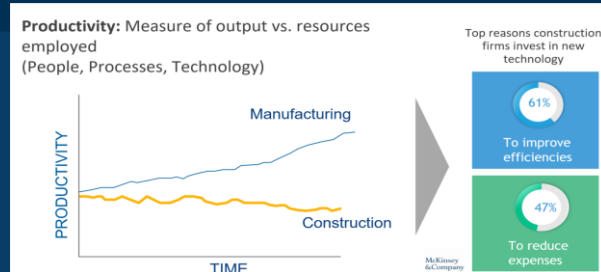
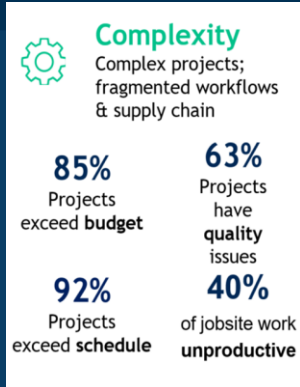


Photo: Per Kollstad / The Norwegian Public Roads Administration

The Norwegian Public Roads Administration and Skanska are opening a new E16 six months ahead of schedule

Published 08.12.2021 08:29

The Norwegian Public Roads Administration and Skanska are speeding up the opening of the new E16 in Jevnaker by six months.



Why Digital Construction?

The global construction industry is underpenetrated with technology - but digital transformation is accelerating



\$15T

Global
Construction
Spend



\$1.6T

Productivity
Lost



\$30B

Addressable
Market



<40%

Technology
Penetration



Connecting a Fragmented Industry

Enabling data to flow seamlessly between all project stakeholders and work processes

- One digital source of truth e.g. Civil + BIM
- Provide Contractors with insight into ongoing and latest design, enabling improved planning of construction work
- Provide Owners full visibility of project data, design and construction processes
- Connect teams and information, communicate directly in the model

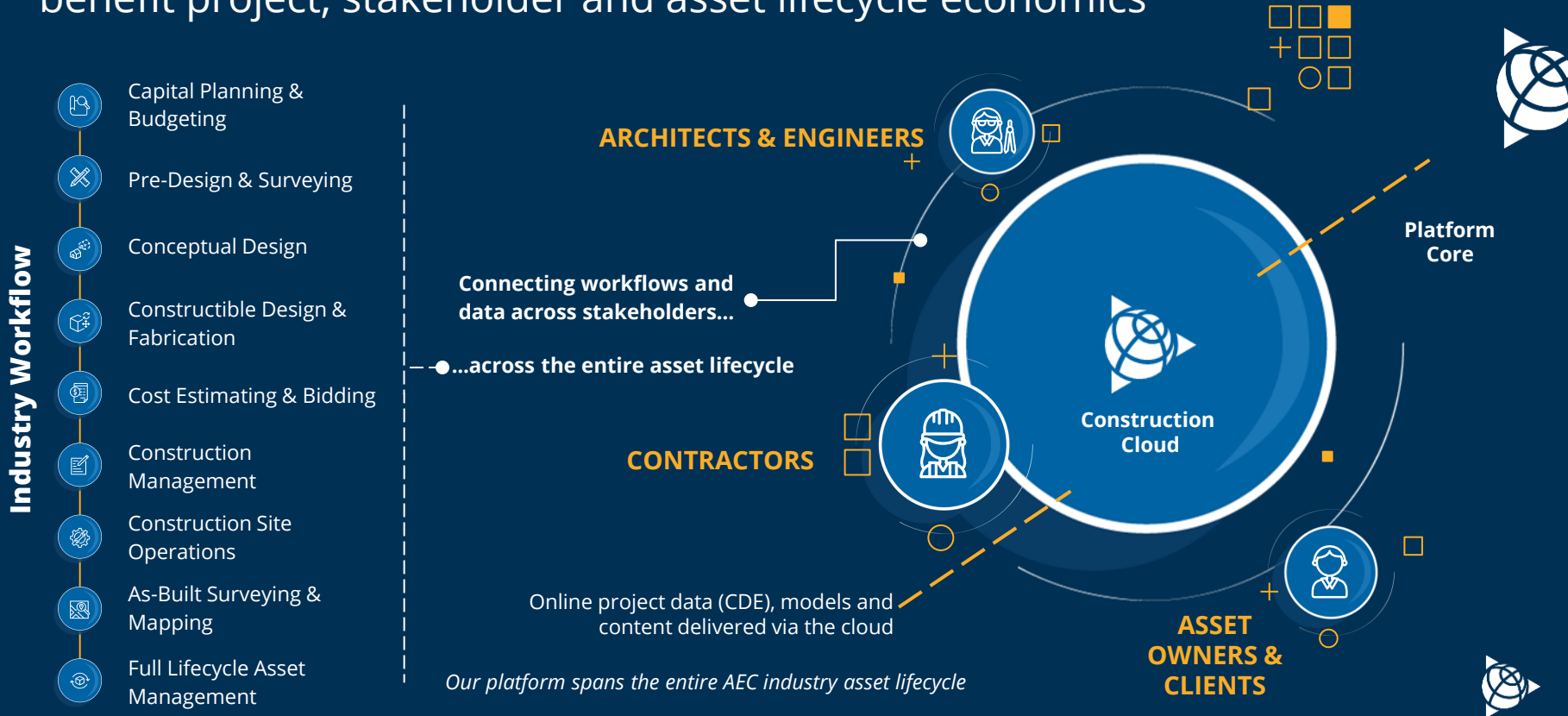


Next Level Technology for Infrastructure

- Coherent common data environment platform for Infrastructure
- Open Standards, API's and Connectors for open collaboration
- Open real-time communication in the browser for stakeholders, tracking who has done what, when
- Increase field productivity and decision making via technology and automation that facilitates connected data flow with enriched data attribution



Closed loop feedback and connected workflows across stakeholders benefit project, stakeholder and asset lifecycle economics



Connecting the Digital and Physical Worlds

Digital

3D Model, Constructible BIM, Digital Twin

Software for design, visualization, data preparation



Common Data Environment

Our platform connects these technologies & workflows together via a Common Data Environment

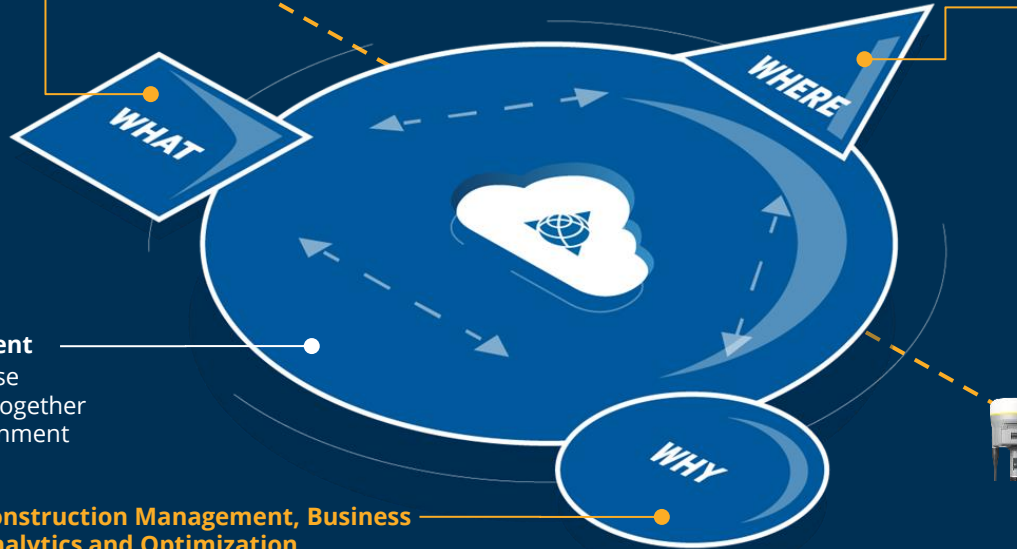
Construction Management, Business Analytics and Optimization

Enterprise resource planning, scheduling, resource management, cost, maintenance and operations, decision support, predictive indicators

Physical

Positioning, Sensing & Control, Field Data

Sensing, measuring & dynamically controlling in a geospatial context



02

Digital Based Workflows



Connected Workflows

e-Builder



Owner/Operator



Cityworks
A TRIMBLE COMPANY

AgileAssets
A TRIMBLE COMPANY

Viewpoint



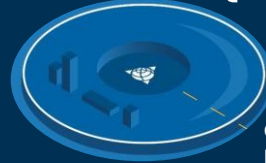
Design / Build
Lead Contractor

SketchUp
Tekla



Trimble Connect

Quadri



Common Data
Environment

Feasibility
and Design

Build
and Operate



Monitoring



Field Crew -
Physical to Digital



Survey Manager, Data
Manager, Office Technician



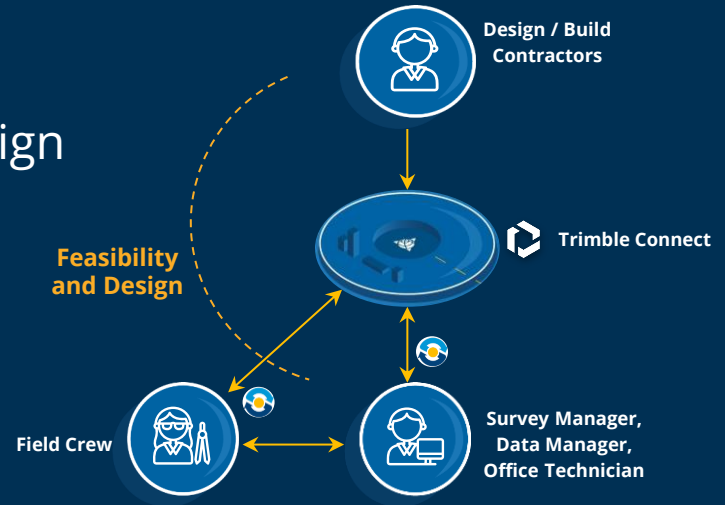
Field Crew -
Digital to Physical



Physical to Digital

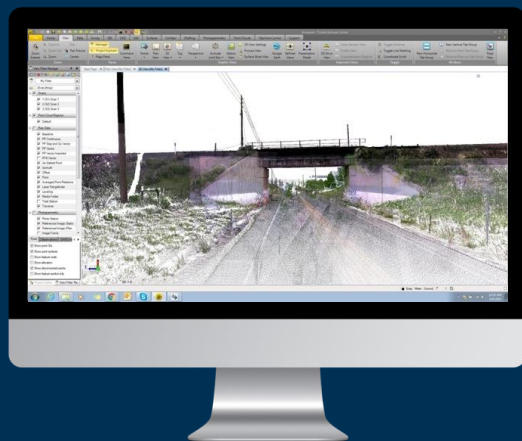
Existing condition data for feasibility and design

- High speed data capture increasing productivity without compromising on accuracy or quality
- Supporting multiple data types (e.g. images, survey data, scan data)
- Reducing traffic management costs and increasing field crew safety
- Efficient and traceable results that deliver confidence you can trust
- Interoperability with CAD and GIS systems for additional data use



Intuitive workflows to rapidly capture, process and manage rich data,
with ease and accuracy

UAV, 3D Scanning and Imagery,
Mobile Mapping

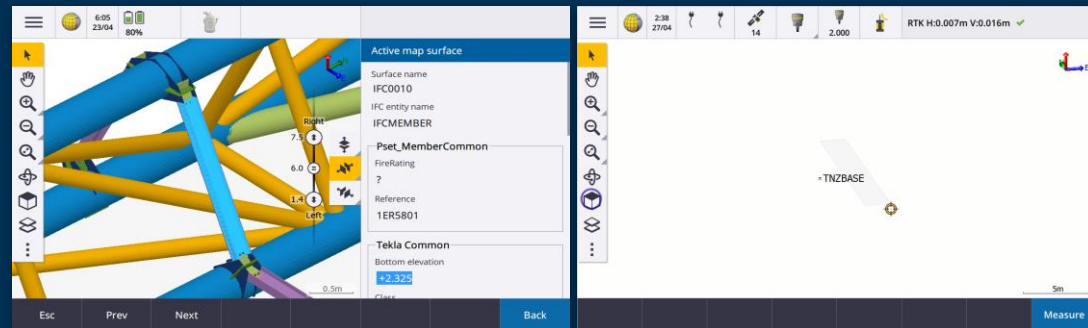
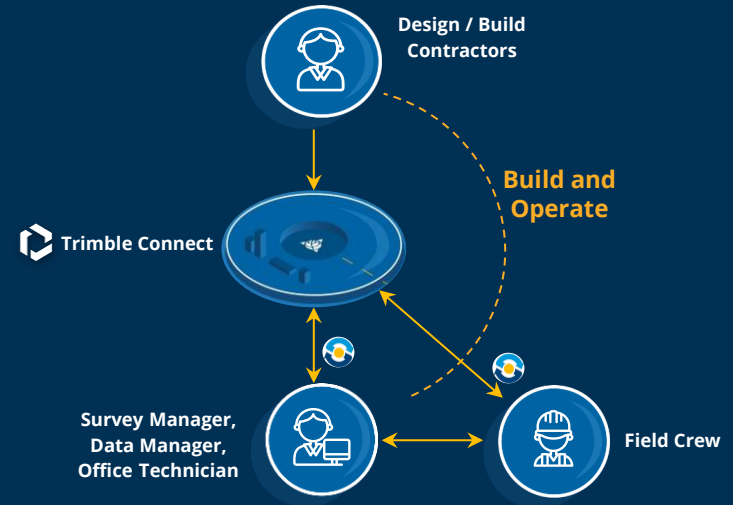


Digital to Physical

Streamlining design to field workflows

Stakeout

- Direct use of design for field stakeout - standards-based designs (IFC, DXF, LandXML,...) reducing computation time and costly errors
- 3D design visualization (incl. AR) increases project understanding and productivity
- Stored design attributes increase traceability throughout design to field

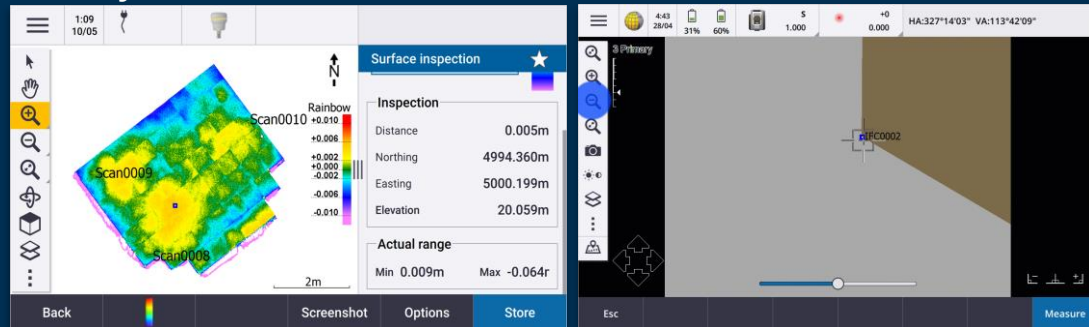
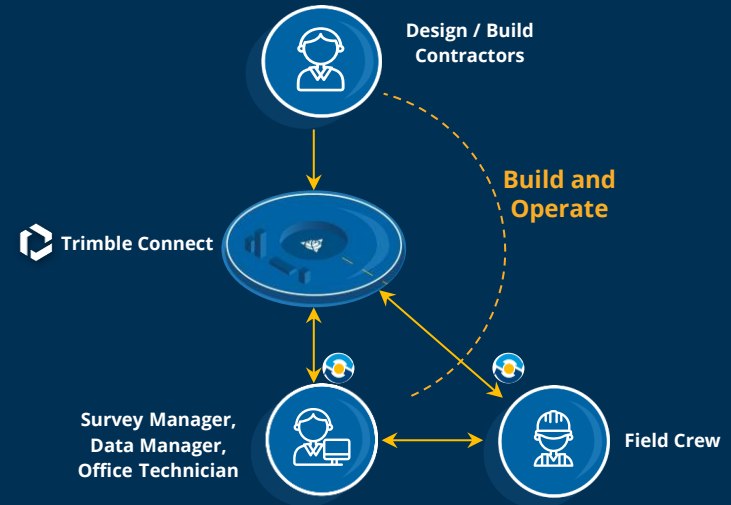


Digital to Physical

Streamlining design to field workflows

As-built inspection

- Verify construction conformance and enable direct action (e.g. additional shotcrete)
- Direct comparison of design, or prior scans, to standards-based designs (IFC, DXF, LandXML,...)
- 3D design visualization (incl. AR) increases project understanding and productivity
- Inspection workflows integrated with the role of office technicians (i.e. TBC, TRW)



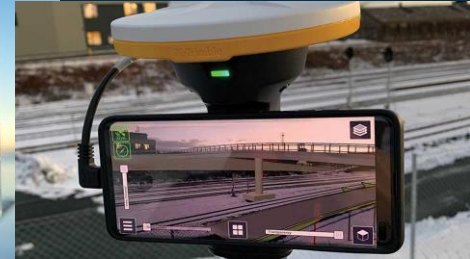
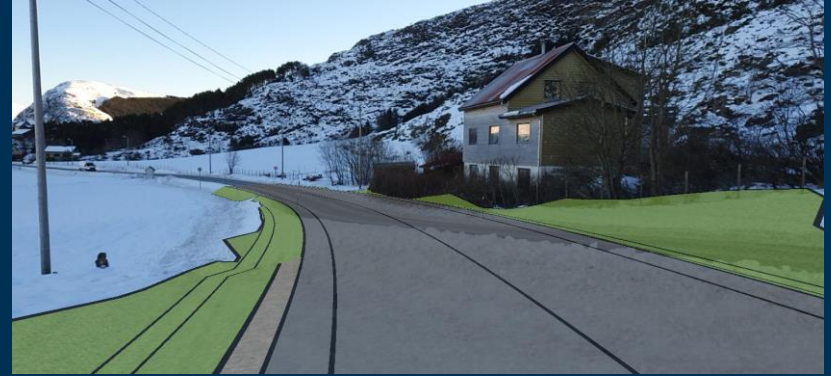
BIM in the field

More focus on building capabilities that facilitates BIM based workflow

- Cloud integration for seamless data flow
- Viewing IFC in 3D viewer for better data understanding and richer data in the field:
 - Access mode attributes
 - Layer handling
 - Pick entities in model/easier stake out
 - Extract line, point and surfaces information directly from model
 - AR with cm and mm accuracy
- Area scan for better productivity
- In-field inspection and reporting



Augmented Reality

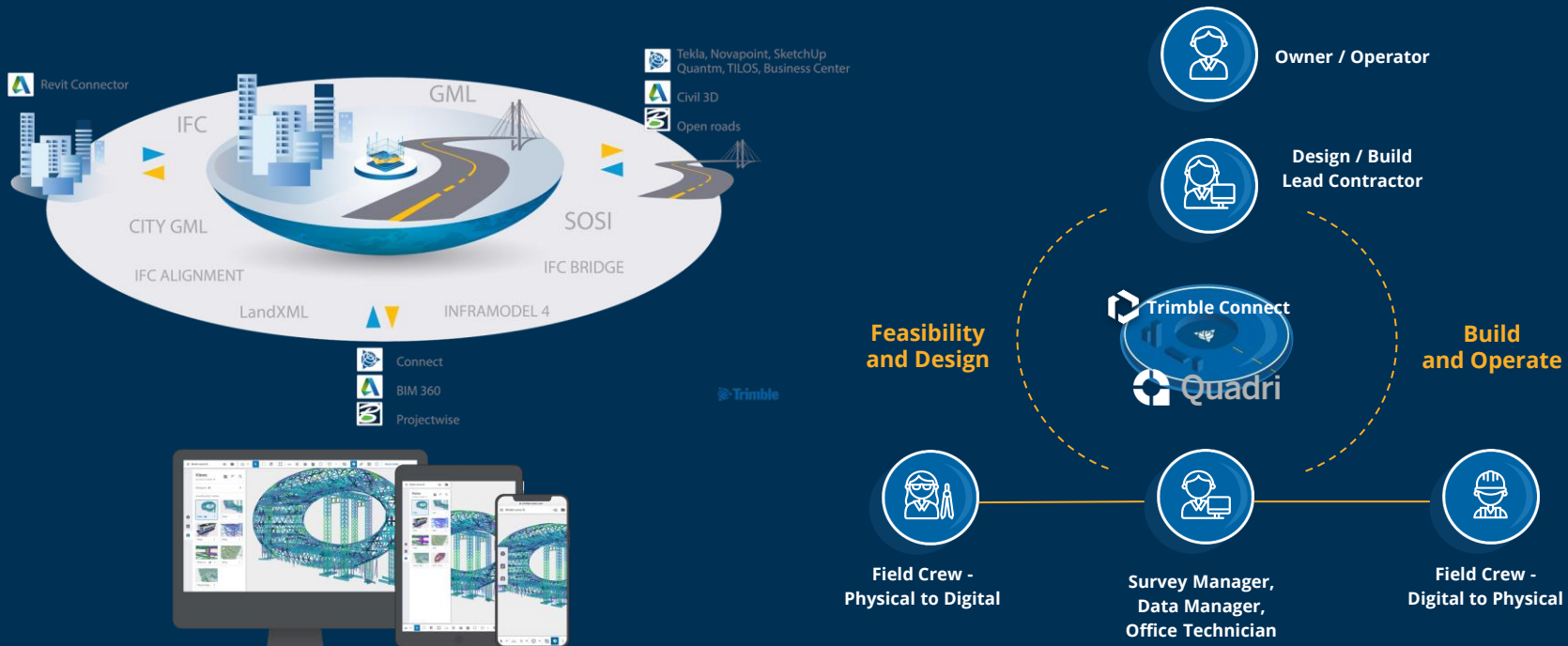


AR for Infrastructure Example



Collaboration and Connectivity

Connected users, data and workflow



04

Success Stories



Ranselva Bridge, Norway

The value of project optimization

Challenge

- Coordinating a client, consultant and contractor team across five countries (and setting a new world record)

Solution

- Use of constructible Bridge Information Modeling (BrIM), augmented reality, and a **100% digital data flow across the entire work process** including design, approval, fabrication and construction

Impact

- World's longest bridge designed, approved and constructed **without a single paper drawing**
- Estimated to have reduced total construction cost by more than 10%

This project paves the way to more efficient and cost effective design, build and operation .. the beginning of the end of the old fashioned 2D-based way of working"

- Gabriel Neves "Ministry of Bridges" media channel

Source: <https://www.fastcompany.com/90761934/the-2000-foot-bridge-was-constructed-without-a-single-drawing>



Bergen Light Rail Project, Norway

Quickly capture and visualize design data

Challenge

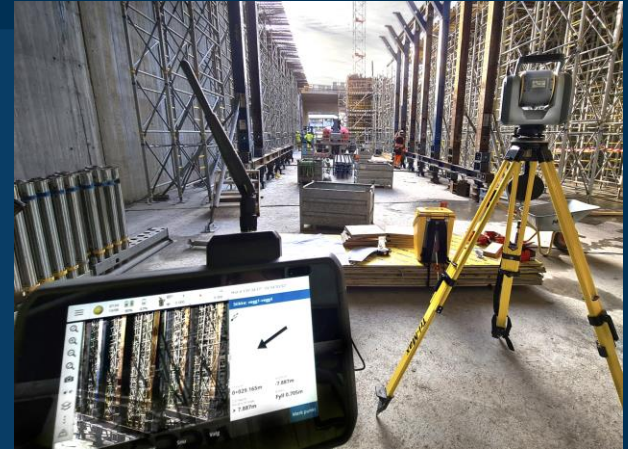
- Municipality, Bybanen Utbygging, decided that the project would be paperless project. **All design data given as complete 3D models** instead of extracted CAD files. To drive efficiency and greener construction process.

Solution

- **NCC adopted Trimble SX12, TSC7 and Trimble Access** to efficiently handle the all-digital workflow and capture detailed as-built data. Design data was sent straight from CDE to Trimble Connect and synced to Trimble Access in the field

Impact

- The direct use of 3D design models in the field saved on computation time, reduced potential for errors and **shortened the workflow from model to stakeout**



"Trimble Access is the only data collector software we have found that is able to handle the IFC-formatted models being used on our project,"

- Richard A. Olsen, Chief Survey Engineer with NCC



Maursund and Kågen Tunnel, Norway

Versatility and ease-of-use to deliver tunneling efficiencies

Challenge

- Tunnel renovation needed to remain open 24/7 to traffic, providing very short windows to work and demanding the highest productivity, reliability and precision

Solution

- Mesta surveyor Sylvia De Vuyst adopted the **Trimble SX12** for the versatility of the green laser pointer for stakeout and 3D scanning for tunnel as-builts; powered by **Trimble Access and Trimble Business Center software tunneling modules**

Impact

- Repetitive process of control, stakeout, as-built can be done quickly in the field.
Scanning reduces tasks that typically take two days down to 4 hrs.
Surface inspections in the field and office provide very fast results.

“The combination of surveying and scanning technology makes it incredibly versatile—I can perform multiple functions from the same set up. It’s fast and precise which is important for such a dynamic environment”

- Sylvia De Vuyst, Tunnel Survey Manager with Mesta



Bergünerstein Tunnel, Switzerland

Workflow capabilities to deliver model-based projects

Challenge

- Donatsch + partner needed to keep project on schedule and built to specification, while adopting model-based workflows. Efficiently manage design updates and communication between stakeholders throughout the 409m tunneling project

Solution

- Variety of data capture technologies: UAV, 3D scanning, **Trimble SX10** with **Trimble Access** and **Trimble Business Center** software. Combining all data in **Trimble Connect**, as the common data environment for collaboration and sharing.

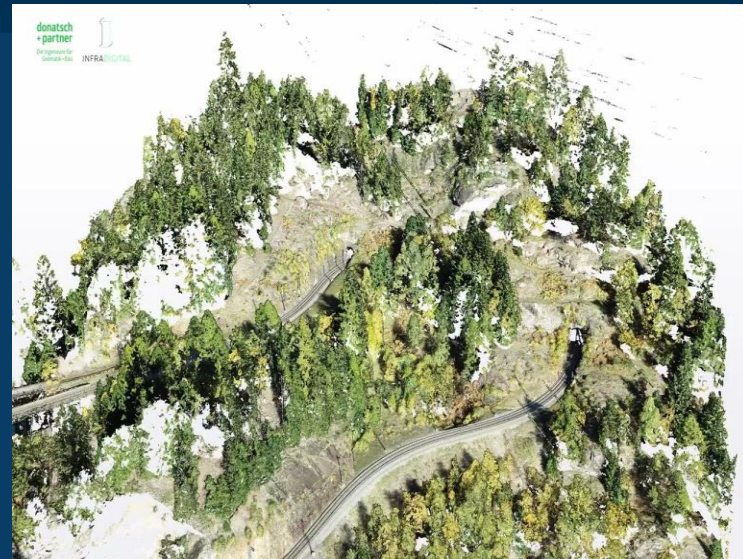
Impact

- Stakeholders were kept up to date with all engineering design, survey and construction data via Trimble Connect

“Trimble Connect is enabling us to effectively communicate the survey work and progress with our contractors, shortening time to decision making and resulting in increased confidence that things are built to specification.”

- Fadri Jecklin, Project Manager and Partner - Donatsch + Partner

Source: Donatsch + Partner AG



Courtesy of:

**donatsch
+ partner**

Die Ingenieure für
Geomatik + Bau



North East Link Project, Australia

Full project, digital delivery

Challenge

- The Victorian Government has specified full digital delivery for a large infrastructure project comprising 26 kms road (new + widening), dual 6.5 km tunnels, 34 kms cycle paths and environmental reserves across the corridor.

Solution

- The lead contractor (SPARK joint venture), is adopting Trimble solutions, including the Trimble SX12, Trimble Access and Trimble Business Center.

Impact

- The heavy adoption of BIM methodologies are expected to minimize cost overruns and provide detailed asset information for operations. The IFC based workflows deliver efficiency in the field and office, providing significant productivity and data quality savings while supporting the final digital delivery.



“CONFIRM WITH SPARK BEFORE USING THIS SLIDE **EXTERNALLY**
+ CONFIRM BIGBUILD.VIC.GOV for image copyright”
- sdf



User Feedback

“In Switzerland we now only receive IFC files as the basis for construction. We need help to generate surfaces from solid IFC files.”

- Martin Kriz, BIM Expert at Strabag



“The use of a BIM collaboration model ensured that we had practically zero downtime caused by design errors. We could produce continuously.”

- Bård Olav Aune, BIM Manager at Skanska Survey



“The 3D discipline models make our work day simpler and more efficient. There are almost no errors or conflicts between the disciplines and the models, from which we build the E22.”

- Peter Bakke, Project Manager at Veidekke ASA



“BIM models contribute undoubtedly in reducing the contractor’s risk. Without Novapoint design and collaboration models, we wouldn’t have managed to get such a good overview of the project in the short tender period.”

- Arve Krogseth, Project Manager at Hæhre



Thank You

Credits

For Questions
or Feedback
please contact:
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