Boris Skopljak, Marketing Director, Trimble Geospatial

21 April 2019

Manufacturer’s Perspective on BIM

Agenda

- Trimble Introduction
- Trimble Buildings and Construction
- Surveying at the Foundation
- Constructible Process
  - Connected
  - Constructible
  - Content Enabled
- Surveyor enabling Tools
- QA

Trimble Inc.

Position

Information

Communication

Transforming the Way the World Works

At Trimble, we have been in the business of crafting confidence for customers for over 40 years.

Founded on the core principles of triangulation, we stand for: Position, Information and Communication.

Where all points unite, you'll find Trimble -with innovation and technology for the future.

Trimble's Transformation

Impact of Innovation

Trimble Snapshot

Company

NASDAQ:
TRMB

$3.13B
Revenue (2018 year end)

34%+
Building & Infrastructure

Innovation

1,200+
Unique Patents

360 Construction Workflow & Technology Patents

14%
R&D re-invested

People

11,000+ Employees in 35 Countries

800+ Construction Professionals

Global Customers in **150** countries

Trimble.

Core Business Franchises

Our core industries are global trillion $ industries which operate in demanding environments, with technology adoption in the early phases

Agriculture

Buildings

Civil Engineering and Construction

Geospatial

Transportation and Logistics

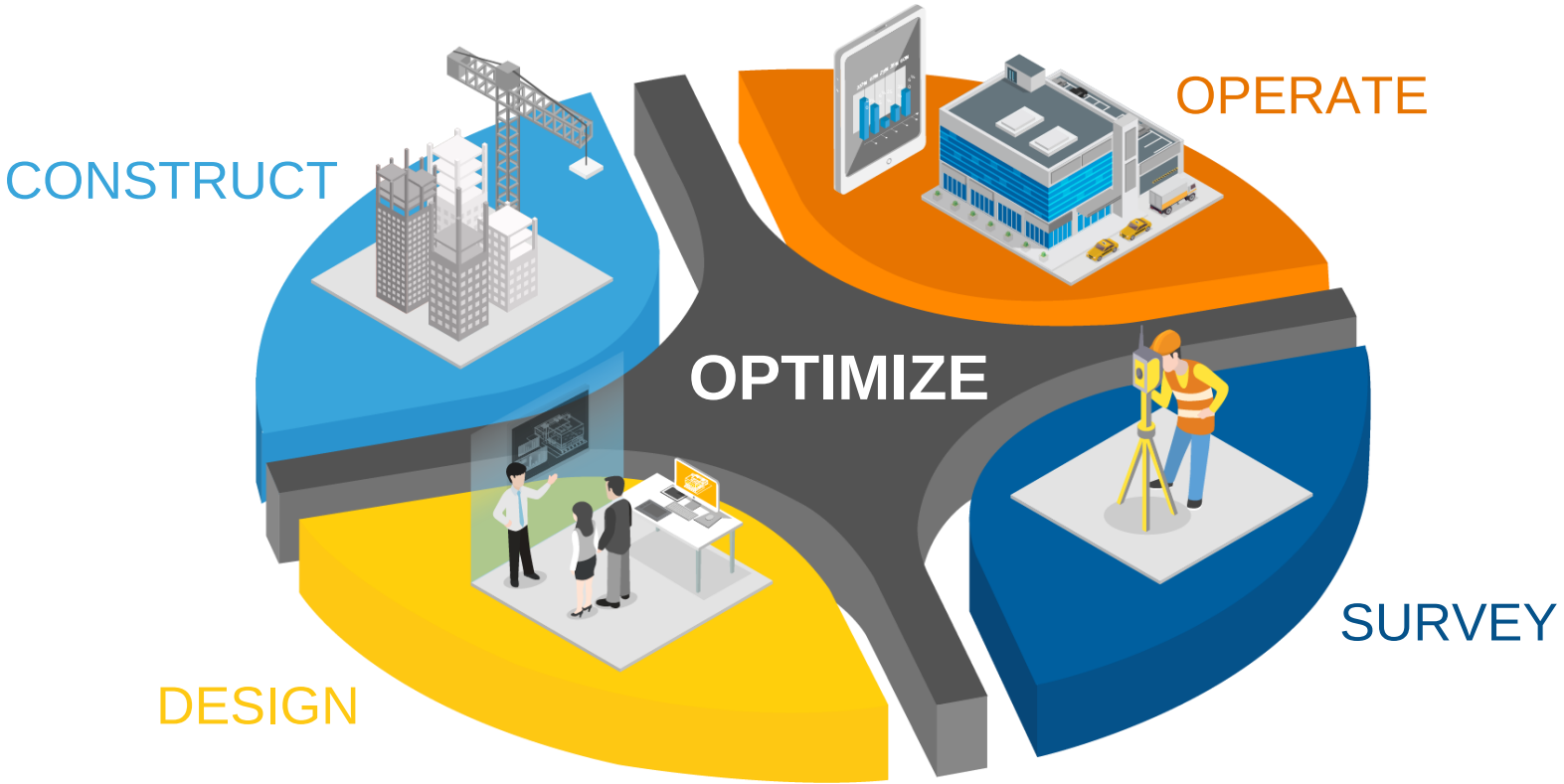
Today, Trimble Is Pervasive

Positively Impacting Productivity, Quality, Safety & Sustainability

Geospatial	Construction	Agriculture	Transportation
• **>70%** of POB[1] top 100 geospatial companies use Trimble • **>10,000** surveyor and mapping firms in N.America are Trimble customers • Joint ventures with Nikon, Russian space agency, Chinese rail authority	• **>28 million** unique SketchUp activations / year • Manage **≈30M** models and components • **>1M** users of Trimble Connect • **>2B** square feet of real estate leases managed • JVs with Caterpillar and Hilti • Multiple OEM relationships for machine control technologies	• **≈150M** acres using Trimble technology • **≈335,000** Trimble displays in the field • **>90,000** customers subscribing to Trimble correction services for high precision GNSS	• Trimble technology on **>85%** of top 200 trucking companies in USA • **>1 million** assets managed directly with Trimble technology on board • **>2 million** assets managed with Trimble solutions (on board and off board)

Support Every Phase of Construction

Providing Solutions across entire project lifecycle



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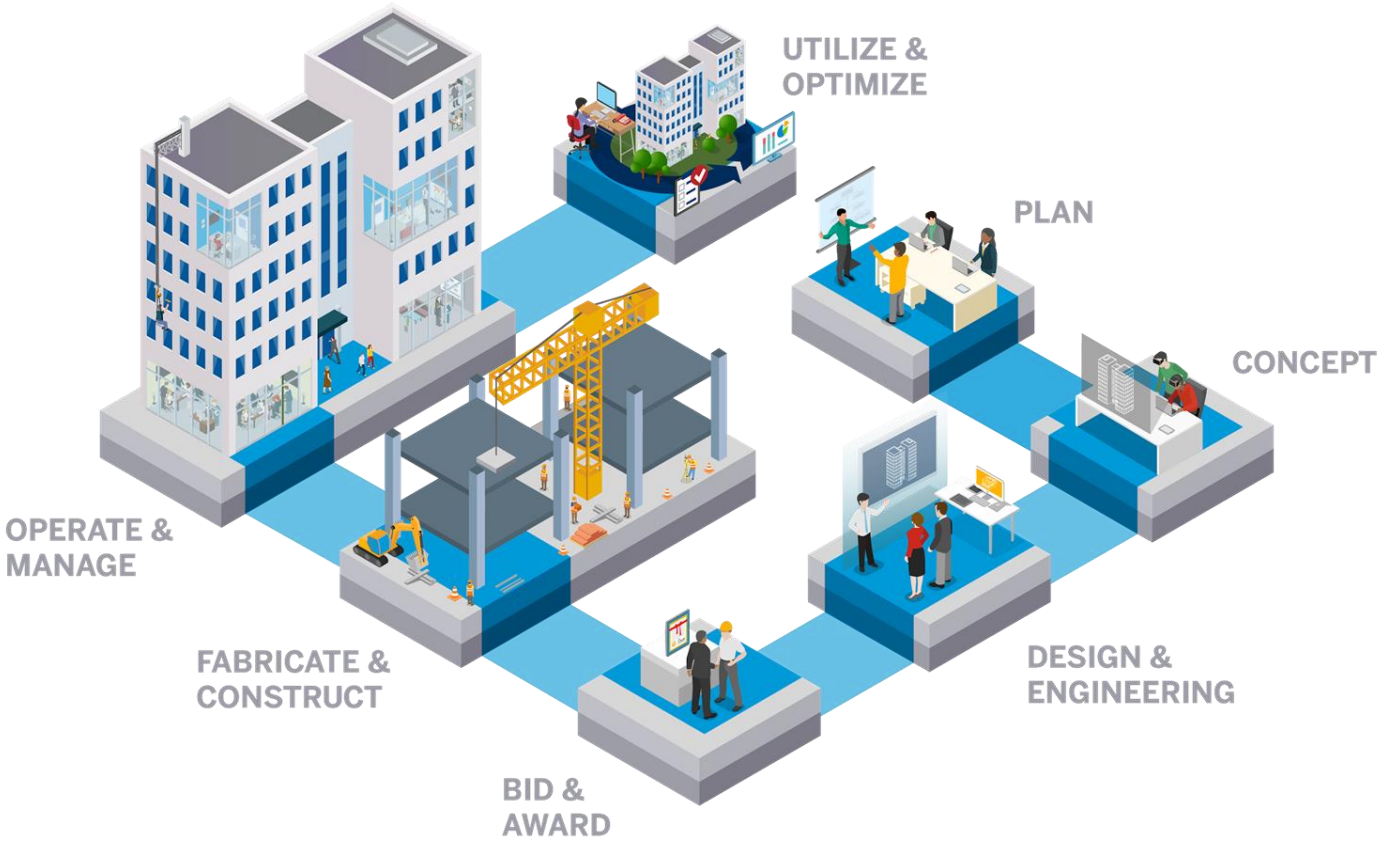
Supporting Every Lifecycle Phase



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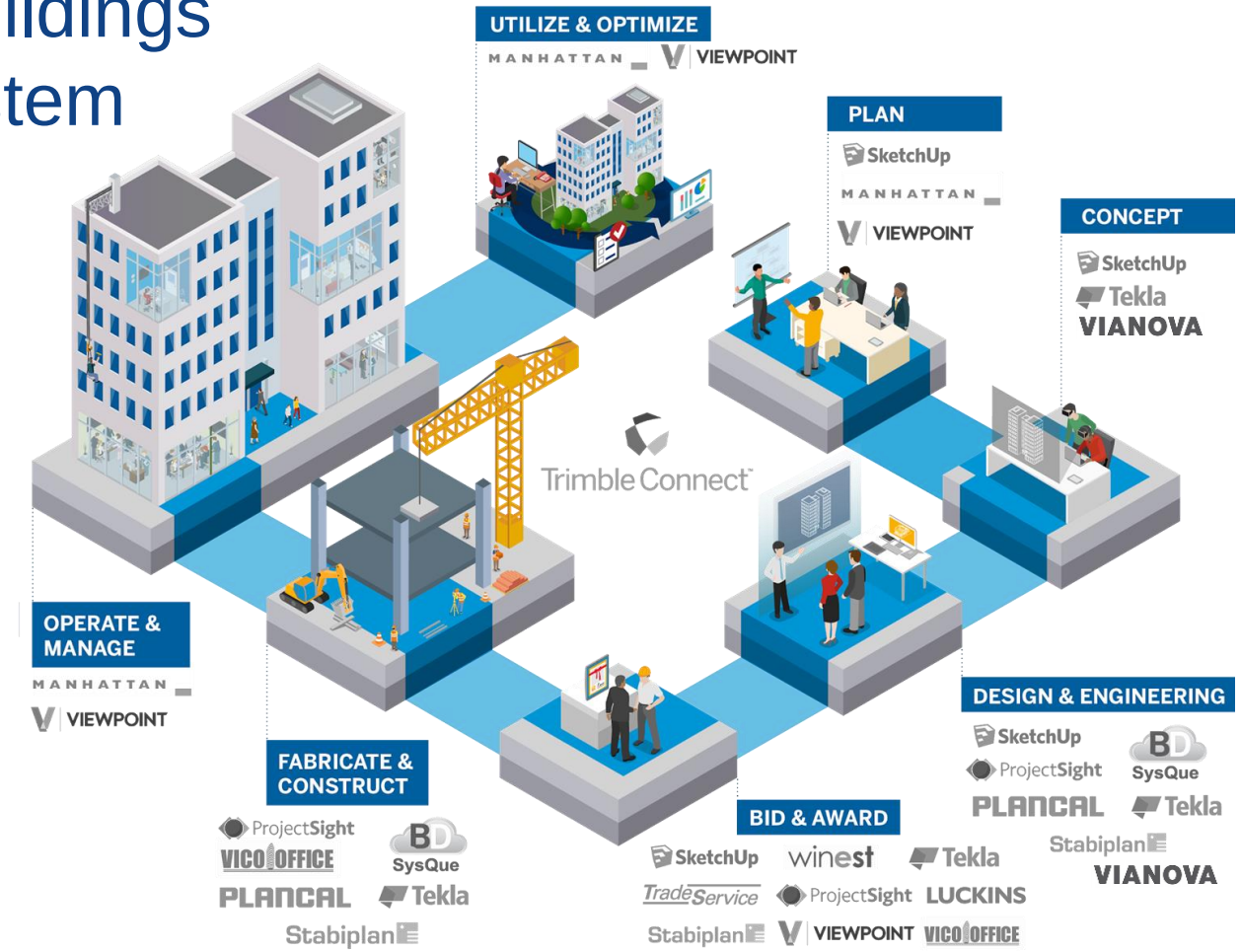
The Buildings Ecosystem



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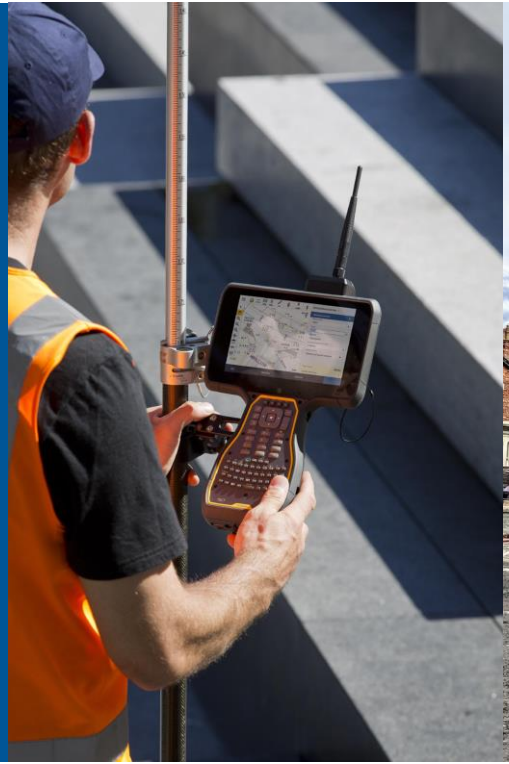
Geospatial Precision Data as Foundation

Surveyors are enabling faster and smarter building, farming and transporting

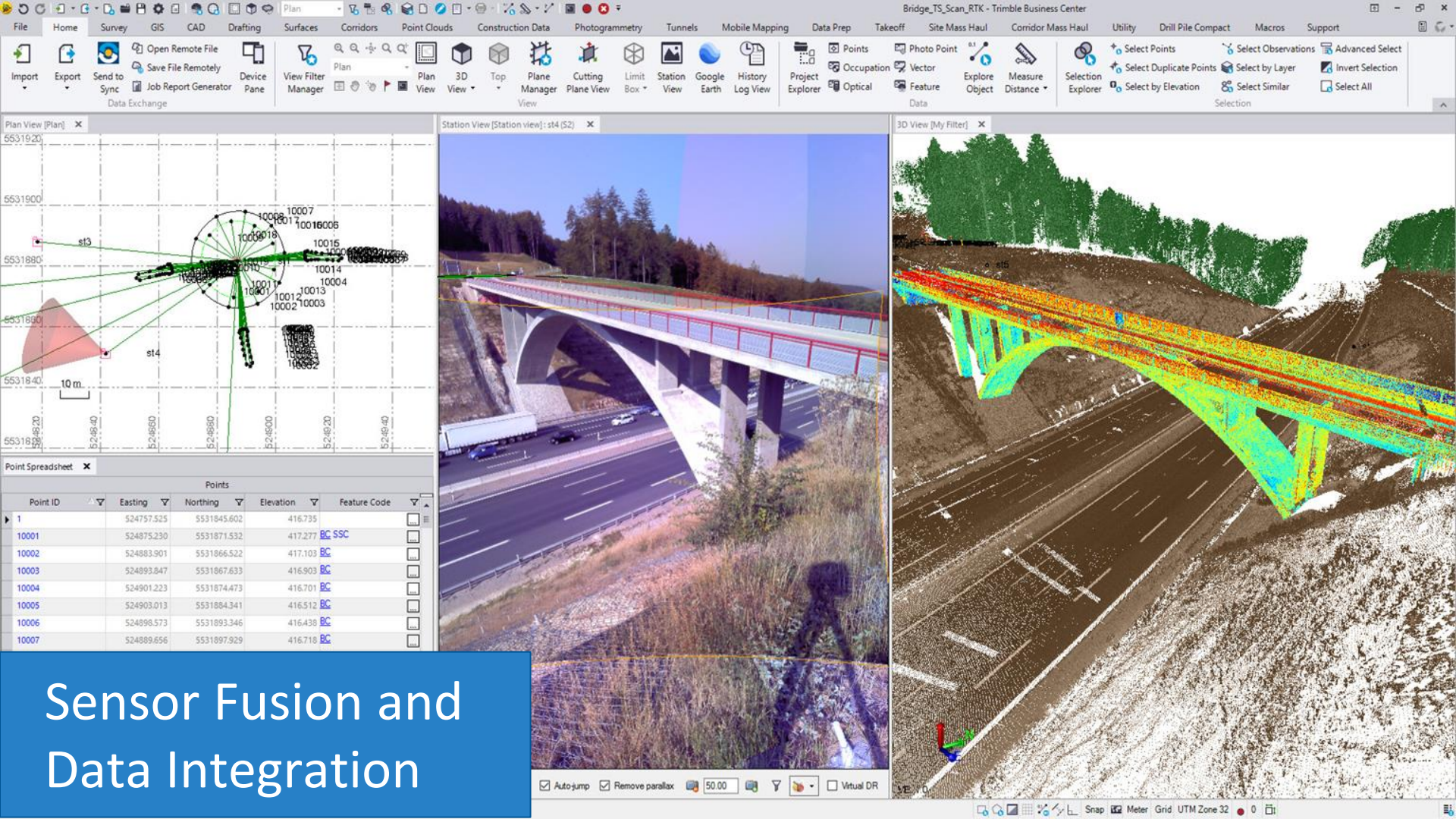
Digital data and workflows support the entire lifecycle

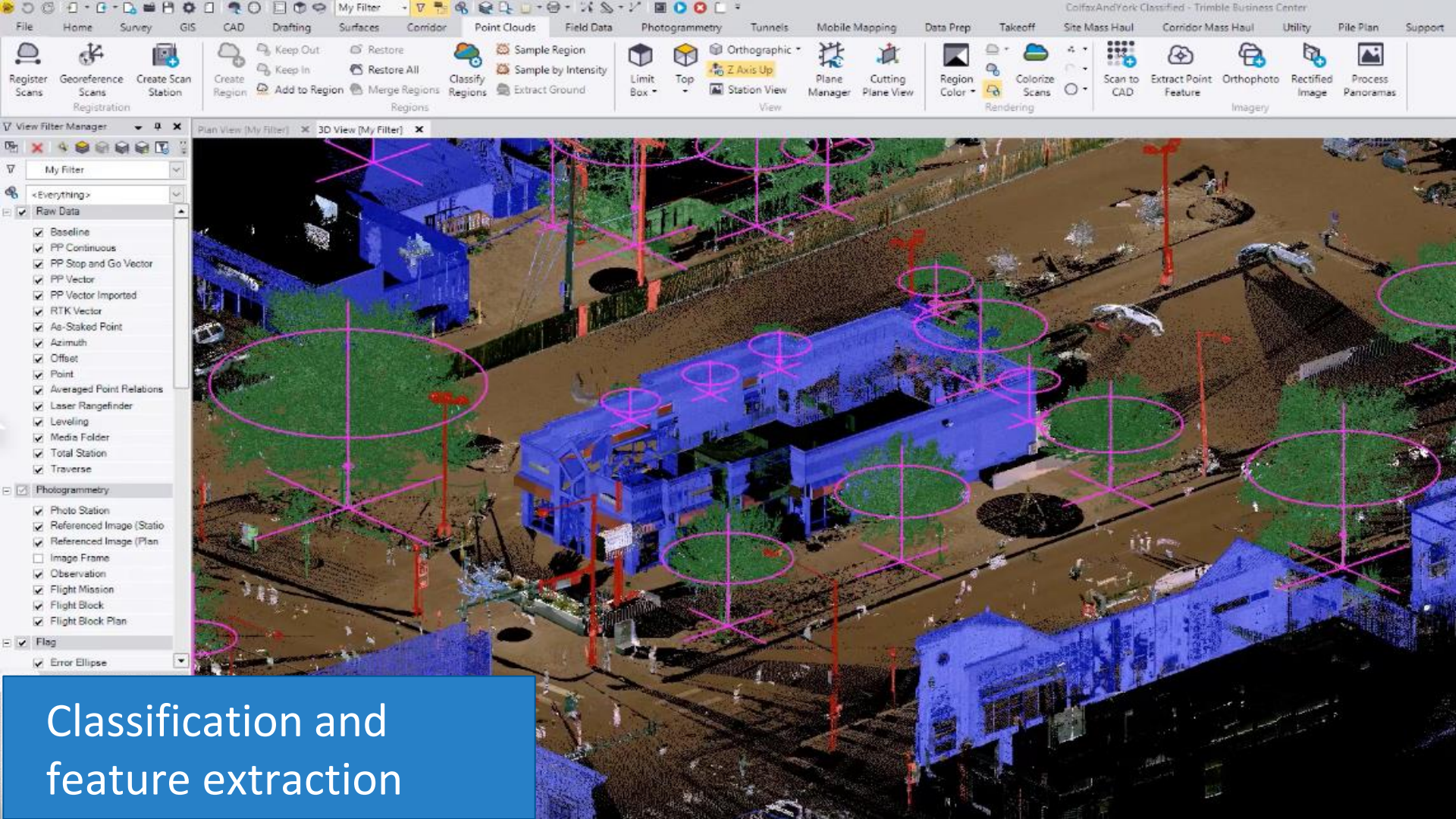
- **Survey**
- **Pre-construction**
- **Site layout**
- **Post-construction**

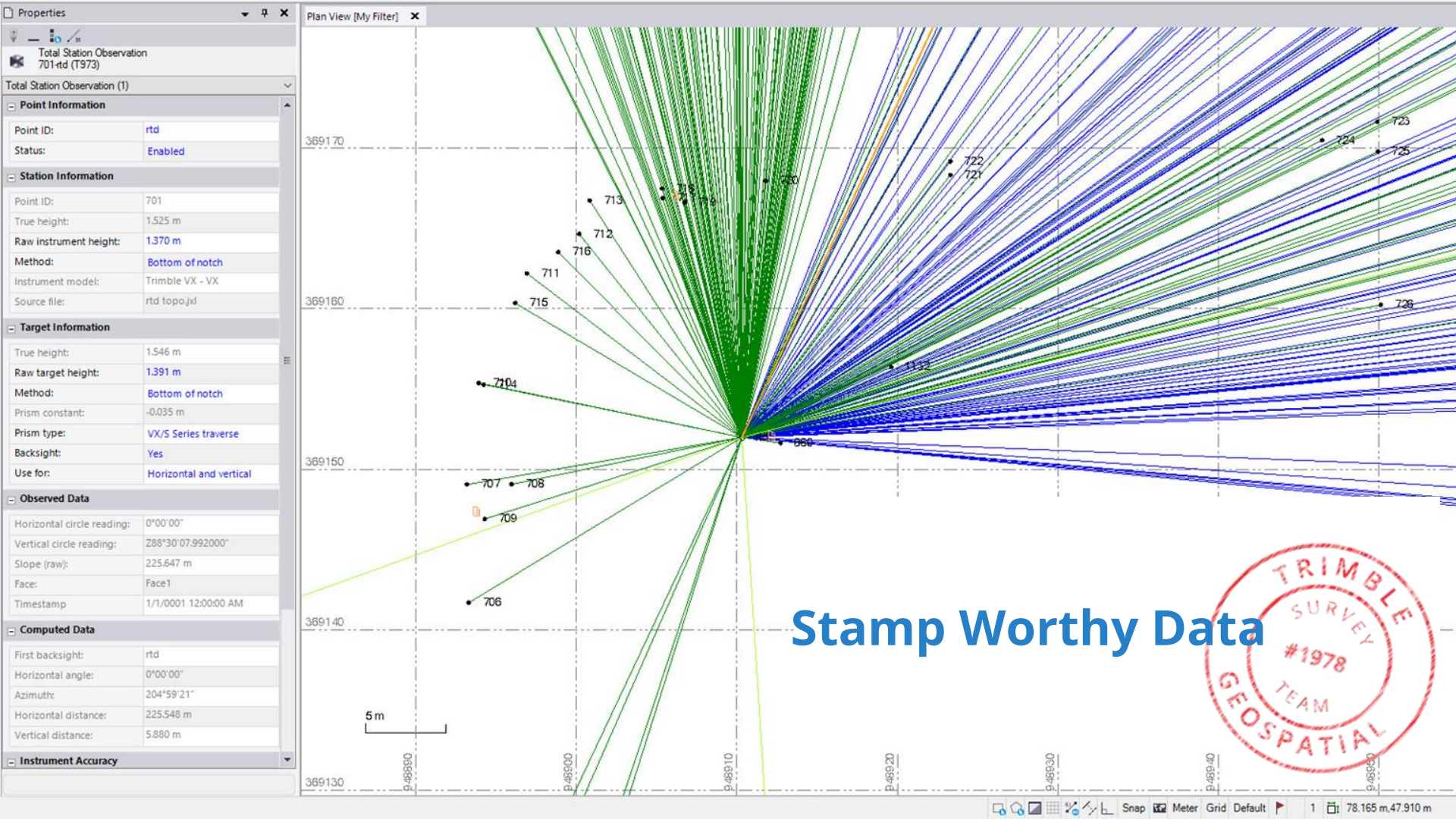


Cost Effective Mass Data collection

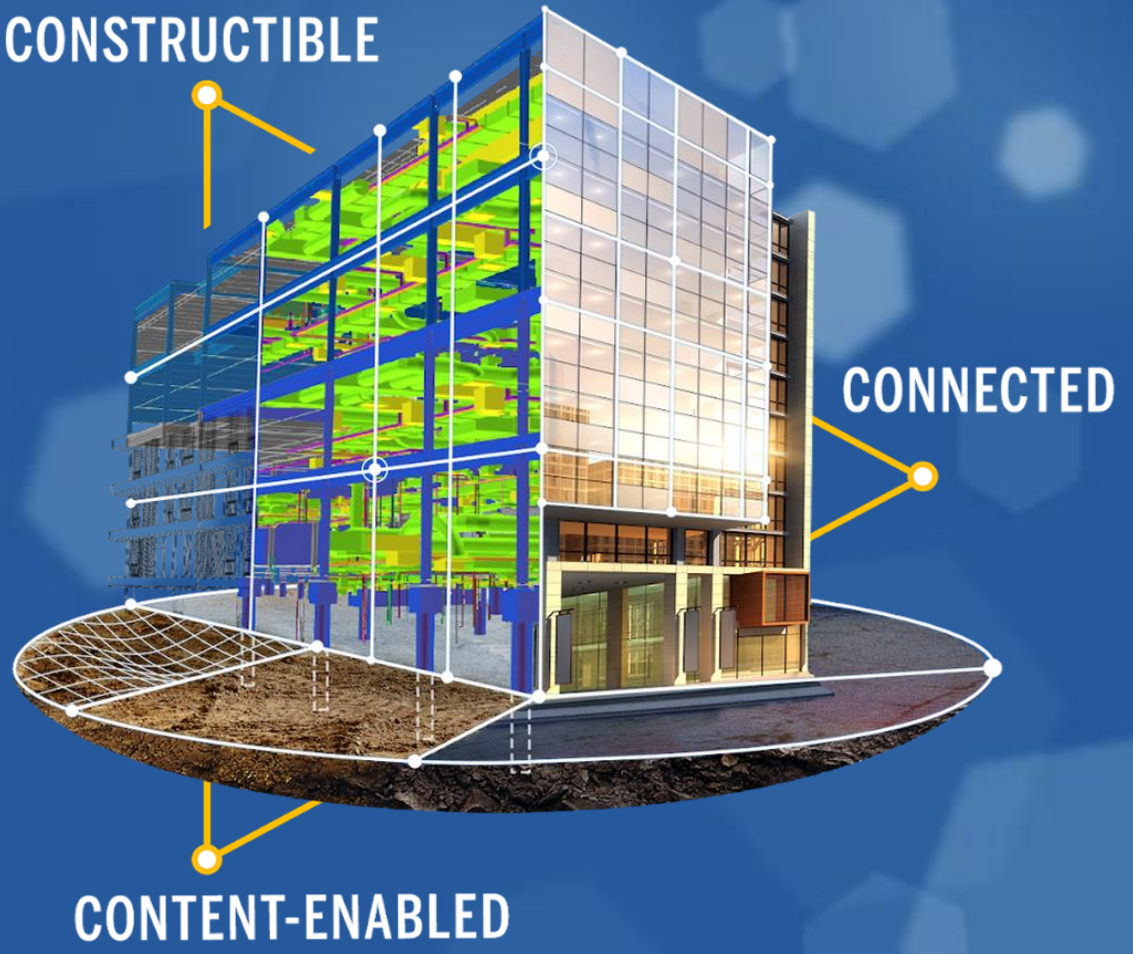
2007 ... 2012 2013 2014 2015 2016 2017 2018

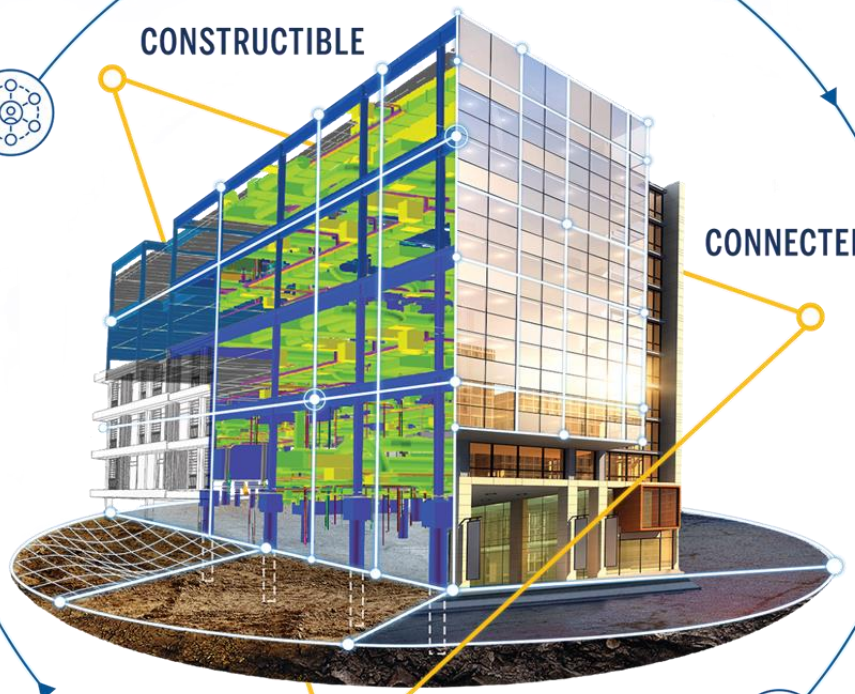

Bridge_TS_Scan_RTK - Trimble Business Center
Plan View [Plan]
Station View [Station view] : st4 (S2)
3D View [My Filter]
Point Spreadsheet
Points
Point ID
Easting
Northing
Elevation
Feature Code
1 524757.525 5531845.602 416.735
10001 524875.230 5531871.532 417.277 BC SSC
10002 524883.901 5531866.522 417.103 BC
10003 524893.847 5531867.633 416.903 BC
10004 524901.223 5531874.473 416.701 BC
10005 524903.013 5531884.341 416.512 BC
10006 524898.573 5531893.346 416.438 BC
10007 524889.656 5531897.929 416.718 BC
st3
st4
10 m
Auto-jump
Remove parallax
50.00
Virtual DR
Snap
Meter
Grid
UTM Zone 32
Sensor Fusion and
Data Integration


Classification and feature extraction


Properties
Total Station Observation
701-rtd (T973)
Total Station Observation (1)
Point Information
Point ID: rtd
Status: Enabled
Station Information
Point ID: 701
True height: 1.525 m
Raw instrument height: 1.370 m
Method: Bottom of notch
Instrument model: Trimble VX - VX
Source file: rtd topo.jxl
Target Information
True height: 1.546 m
Raw target height: 1.391 m
Method: Bottom of notch
Prism constant: -0.035 m
Prism type: VX/S Series traverse
Backsight: Yes
Use for: Horizontal and vertical
Observed Data
Horizontal circle reading: 0°00'00"
Vertical circle reading: Z88°30'07.992000"
Slope (raw): 225.647 m
Face: Face1
Timestamp 1/1/0001 12:00:00 AM
Computed Data
First backsight: rtd
Horizontal angle: 0°00'00"
Azimuth: 204°59'21"
Horizontal distance: 225.548 m
Vertical distance: 5.880 m
Instrument Accuracy
Plan View [My Filter]
Stamp Worthy Data
TRIMBLE SURVEY #1978 TEAM GEOSPATIAL
5 m
Snap Meter Grid Default
78.165 m,47.910 m

The Constructible Process





Estimates that improve confidence, reducing waste

Data accurate enough to directly control field work, limiting rework

Leverage historical data to improve future performance

Construction content you can re-use to improve efficiencies

Predictable & on-time completion reduces risk

Open data enables real-time collaboration

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A Digital Transformation Has Begun

Adoption

Growth in AEC technology from 300 vendors in 2016, to 1,000 to 2017 to over 2,000 in 2018

Noninvasive & Wearable Technology Increasing

240%
Increase in Drone Adoption

80%
Capture FIeld Data on Mobile Devices

80%
Prefer Cloud to On-Premise

AEC Firms hiring data scientists, Chief Data Officers and Blockchain experts

UK Government moving beyond BIM standards and COBIE drops to Common Data Environments (CDE)

Return on Investments

30%
Reduction in Errors and Clashes with Mixed Reality

Free up Capital by
5-15%
Allocating Money to Value Add Projects

90%
Decrease In Time Measuring and Processing Site Data

10%
Compression in Project Schedule

80%
Reduction in Rework

30%
Increase in Prefab

50%
Increase in Productivity of FIeld Tasks

5%
Increase in Accuracy of Estimates

30%
Reduction in Operations and Maintenance

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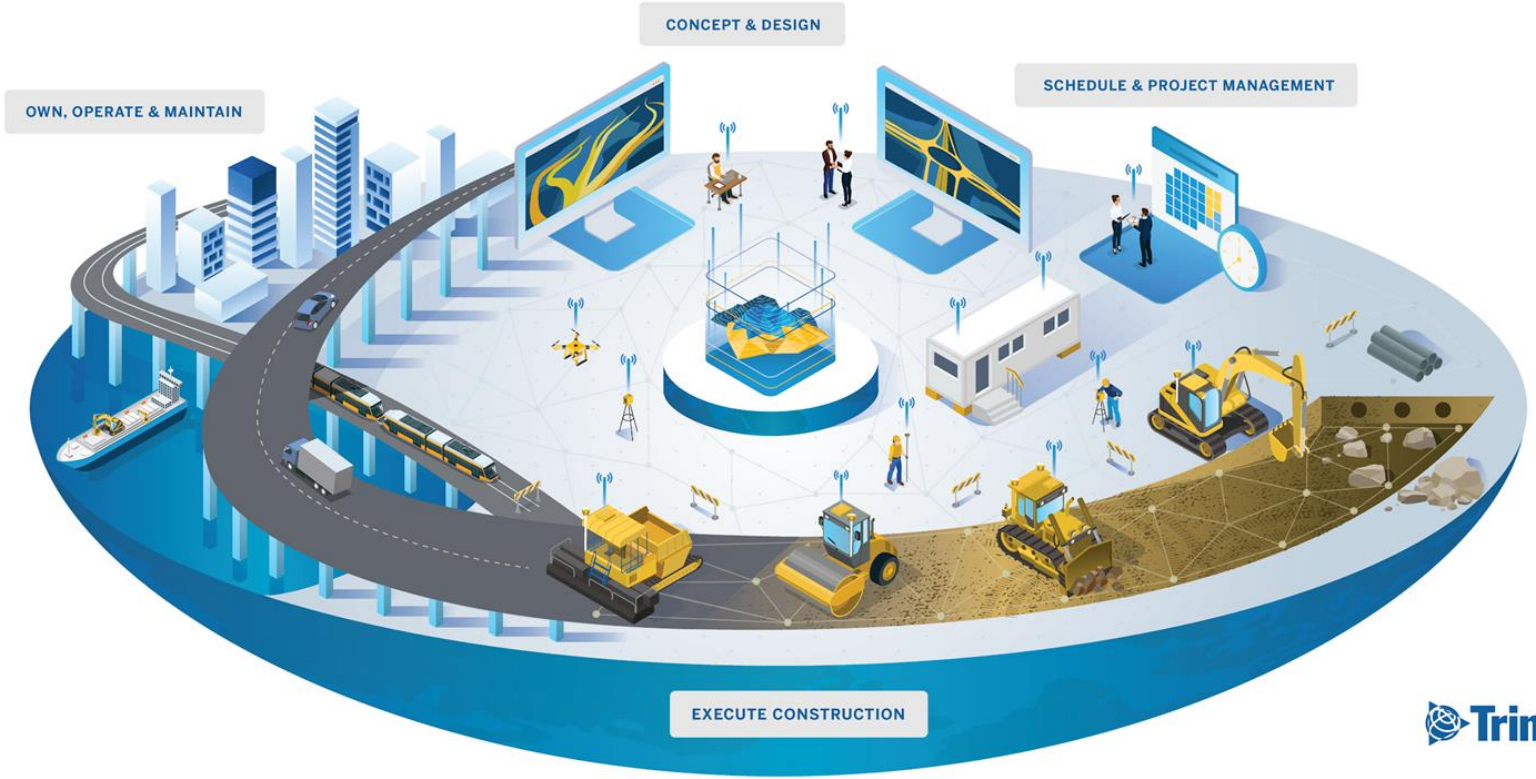
THE 3 C'S

Connected - Constructible - Content

Connected Construction

Connected Site workflows are essential to the buildings & infrastructure ecosystem



Connected Construction

The Right Data To The Right Person At The Right Time

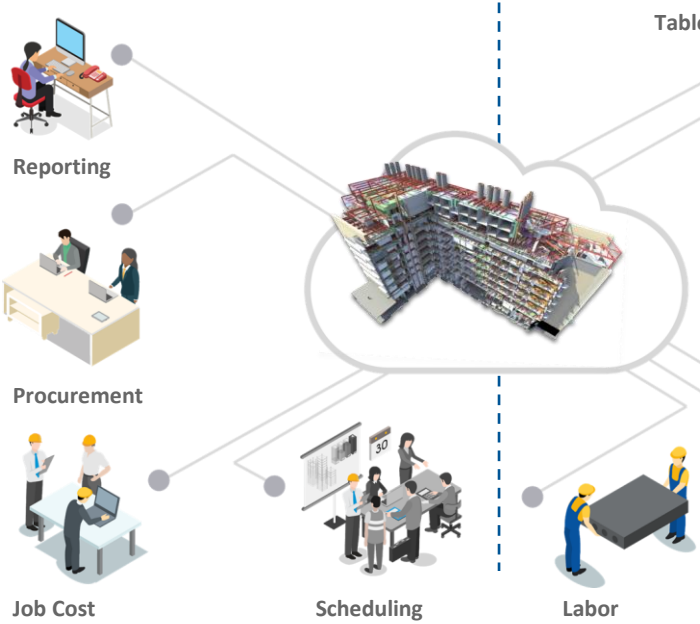
Between Stakeholders

OWNER Capital Program Management

GENERAL CONTRACTOR Project Management and Controls

SELF PERFORM CONTRACTOR Production Schedule, Work Order Management and As-Build QA

In the Office



In the Field

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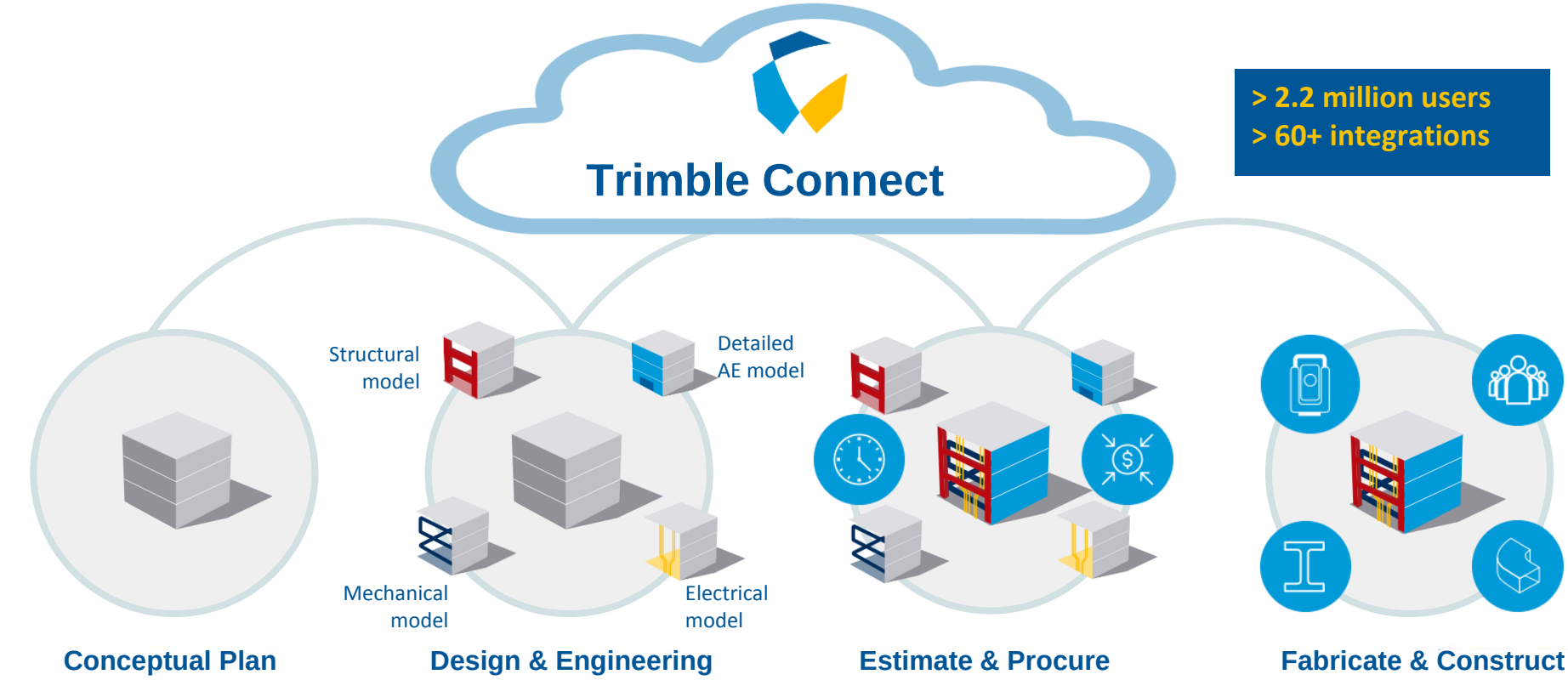
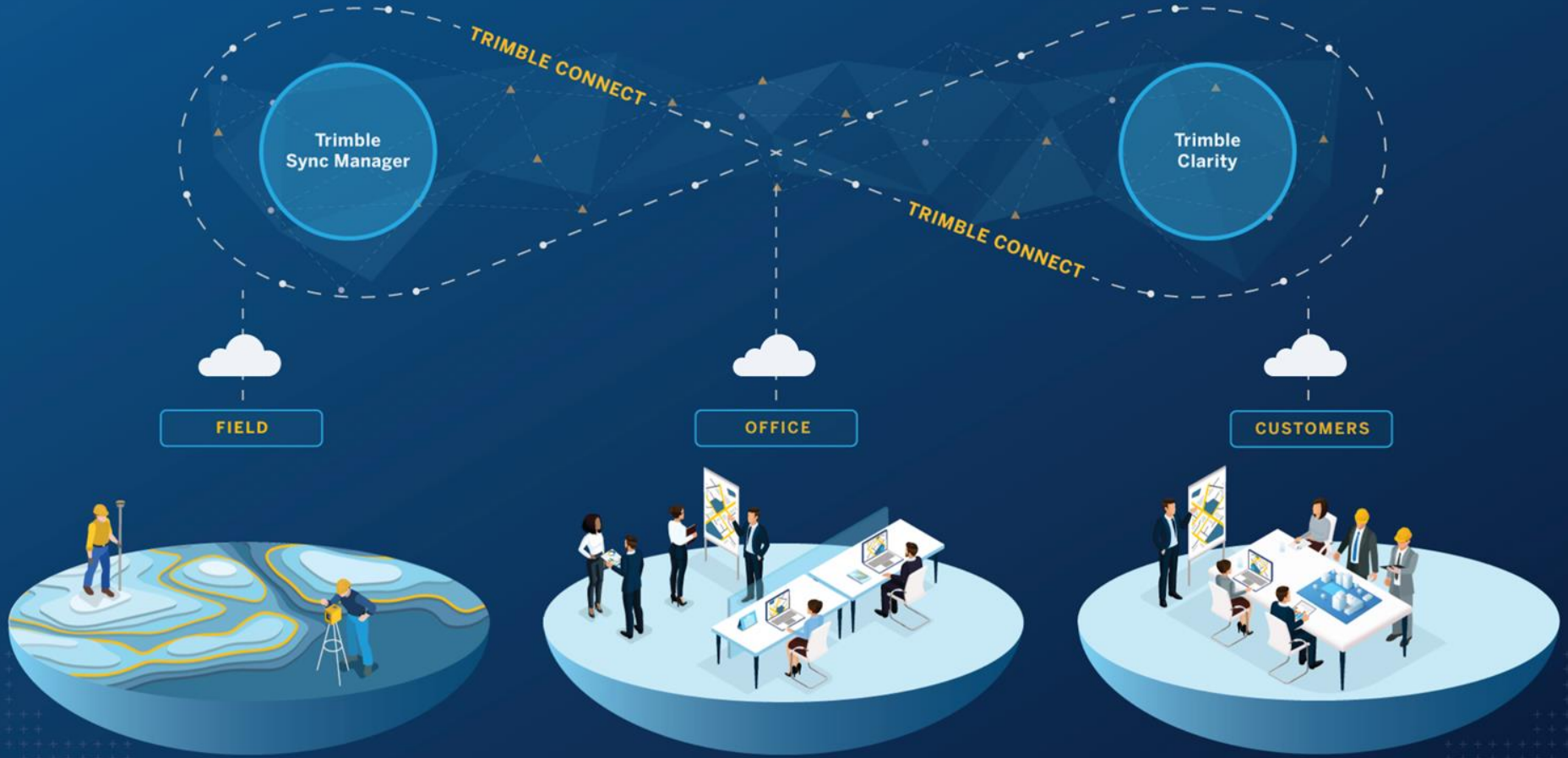
Connected Construction - Trimble Connect

1D-5D Project Data Management & Project Performance Ecosystem

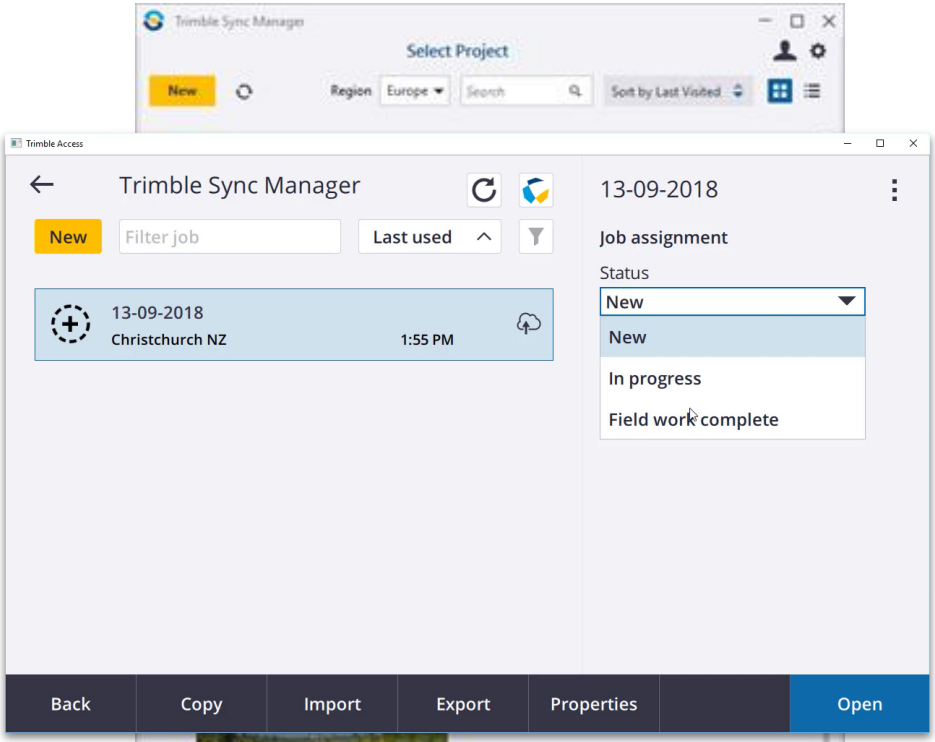


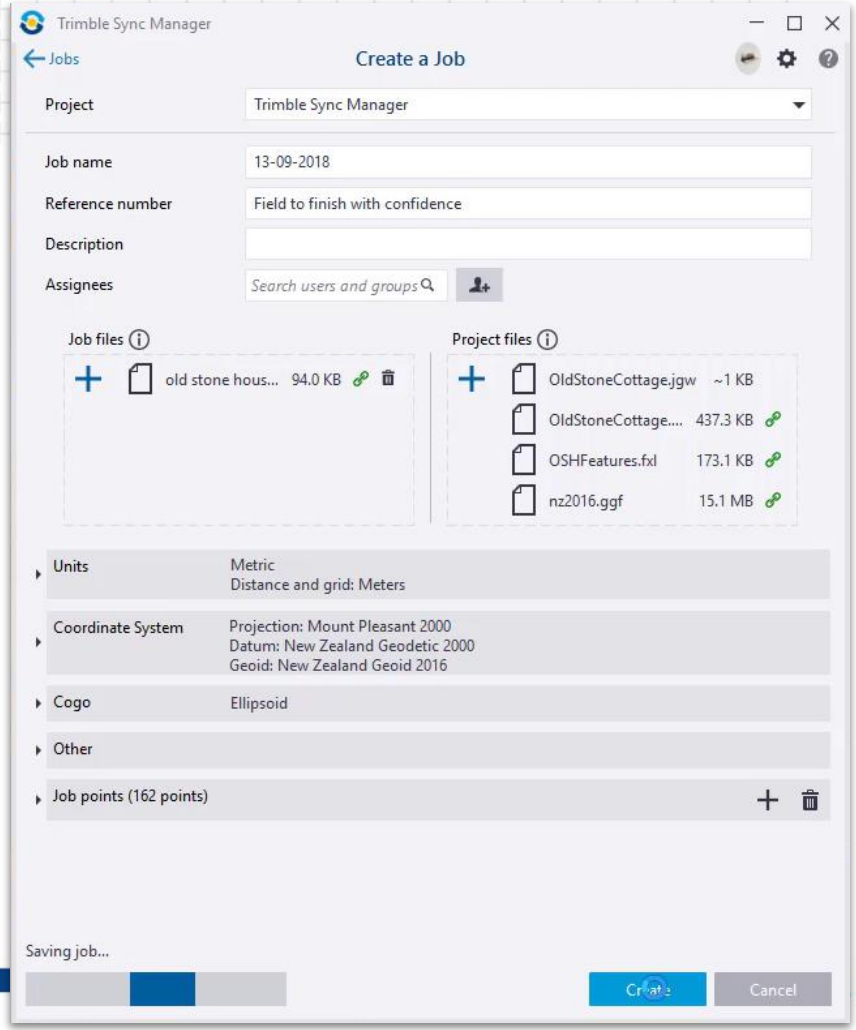
Trimble | CLOUD TECH



Trimble Sync Manager

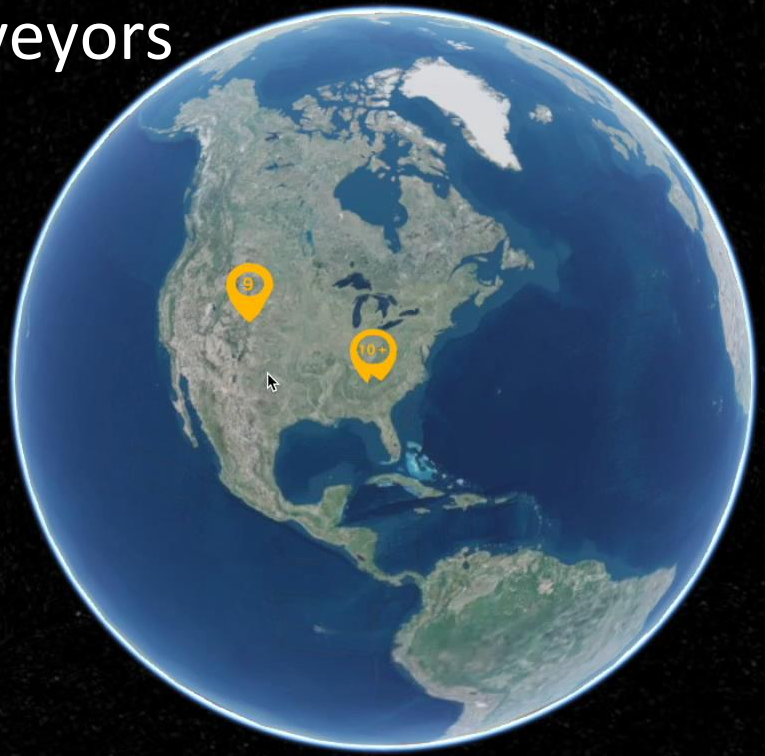
Connecting Survey Field and Office





Trimble Clarity -

Connecting Surveyors and Customers

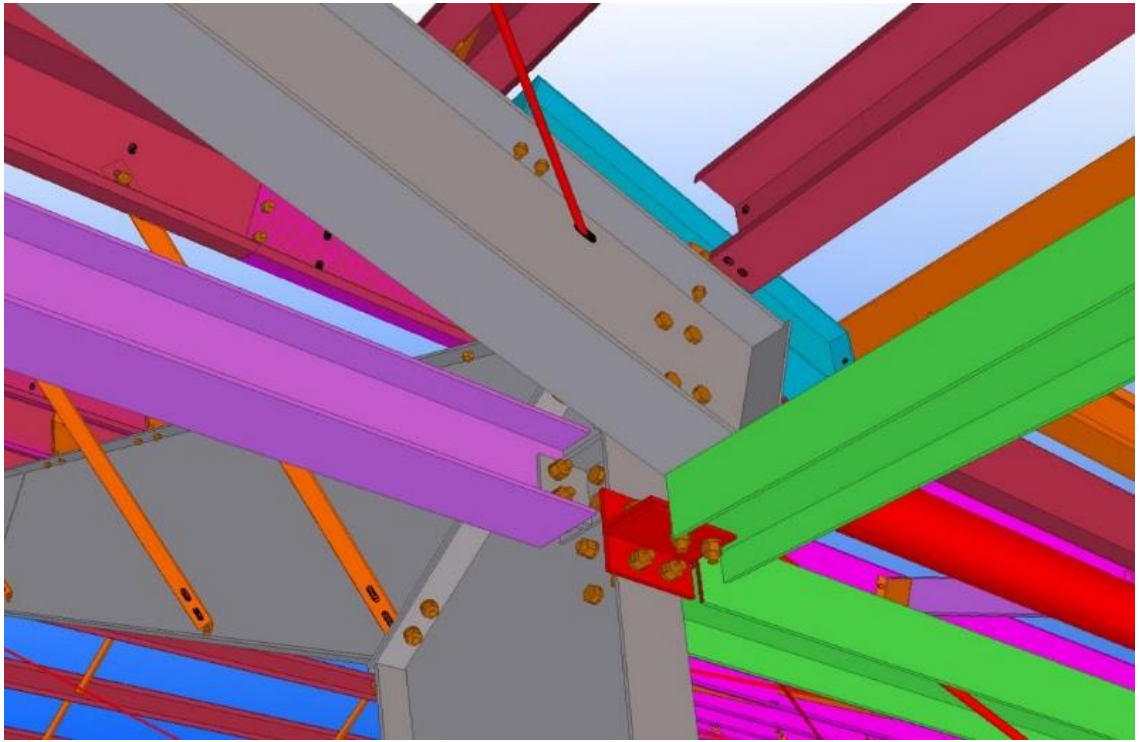


Search

JF

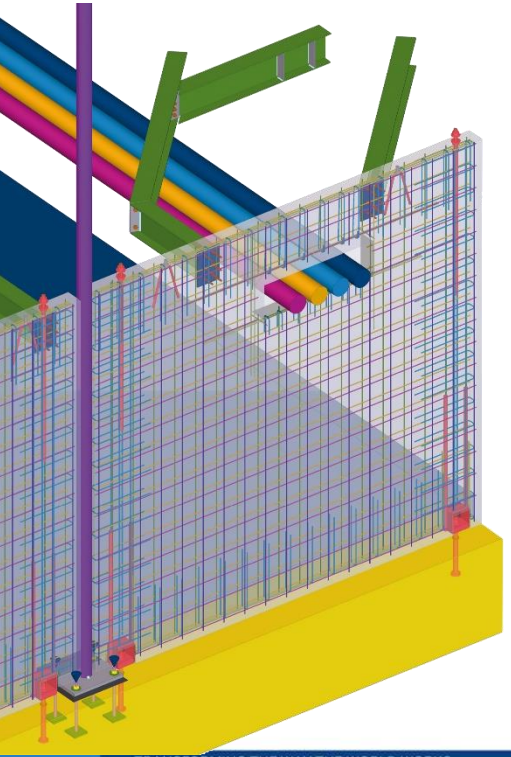
Constructible

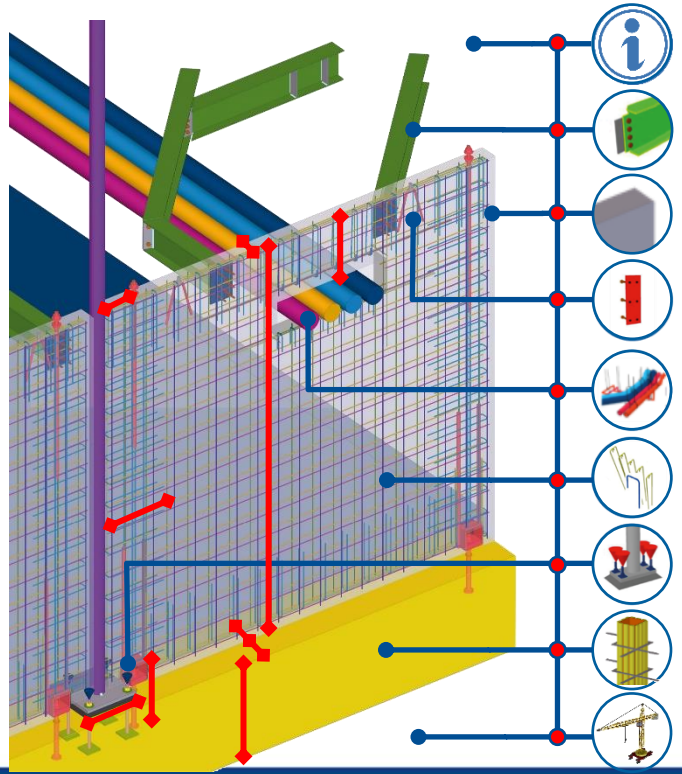
Precise, constructible models, so accurate you can build from it



Constructible

A high level of development (LOD) in the model detail using dependencies and parametric design





Parameter =
Defines an object, described as attributes and "I" in BIM

Parametric =
Describing the relationships of elements within one object or group objects respective to each other.

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Traditional 3D-CAD Model

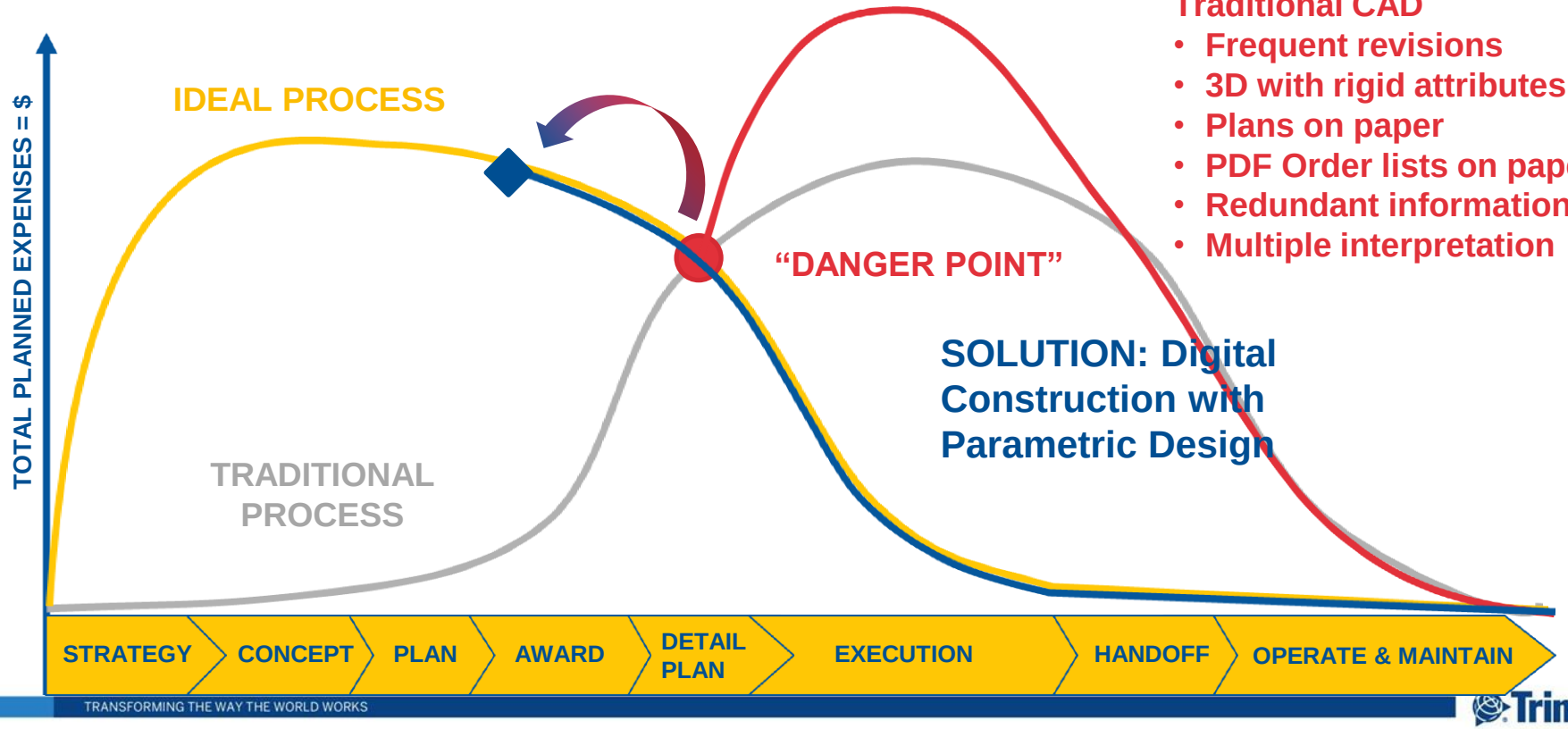
Constructible BIM Model

Traditional and Ideal Process

DANGER CONDITION:
Maximum possible effort with Traditional CAD

- **Frequent revisions**
- **3D with rigid attributes**
- **Plans on paper**
- **PDF Order lists on paper**
- **Redundant information**
- **Multiple interpretation**

Digital Construction with Constructible Model



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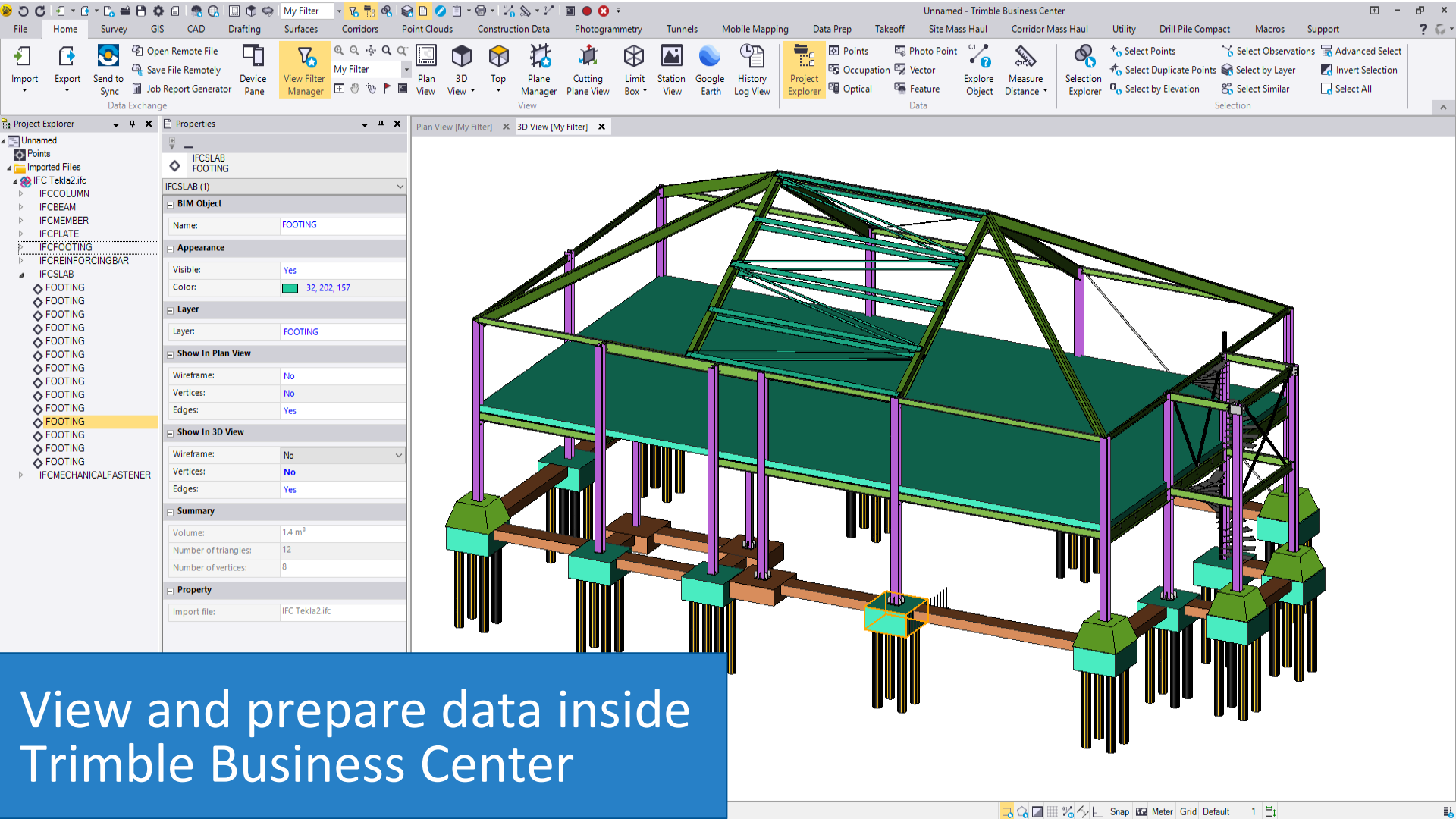
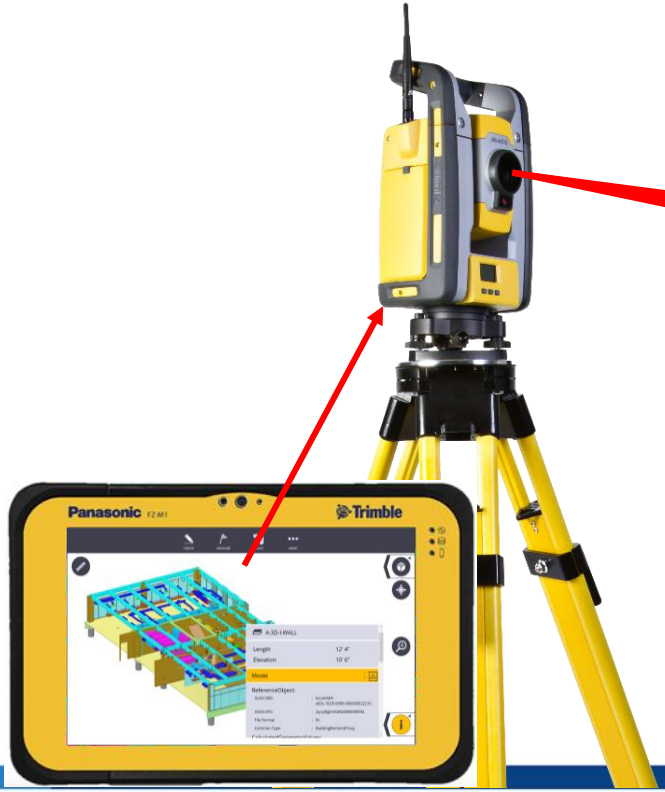
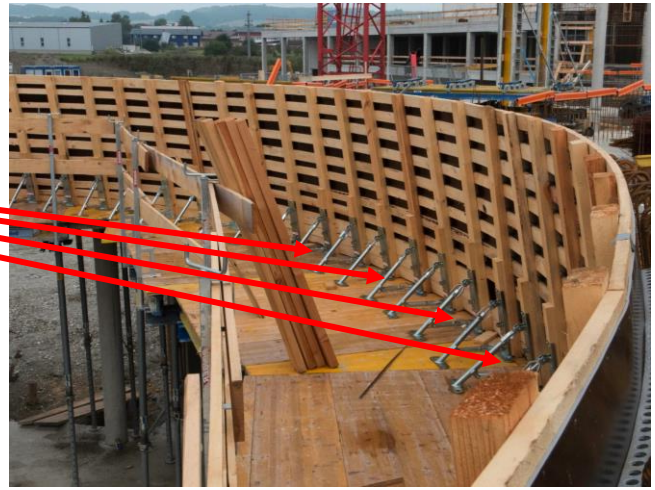
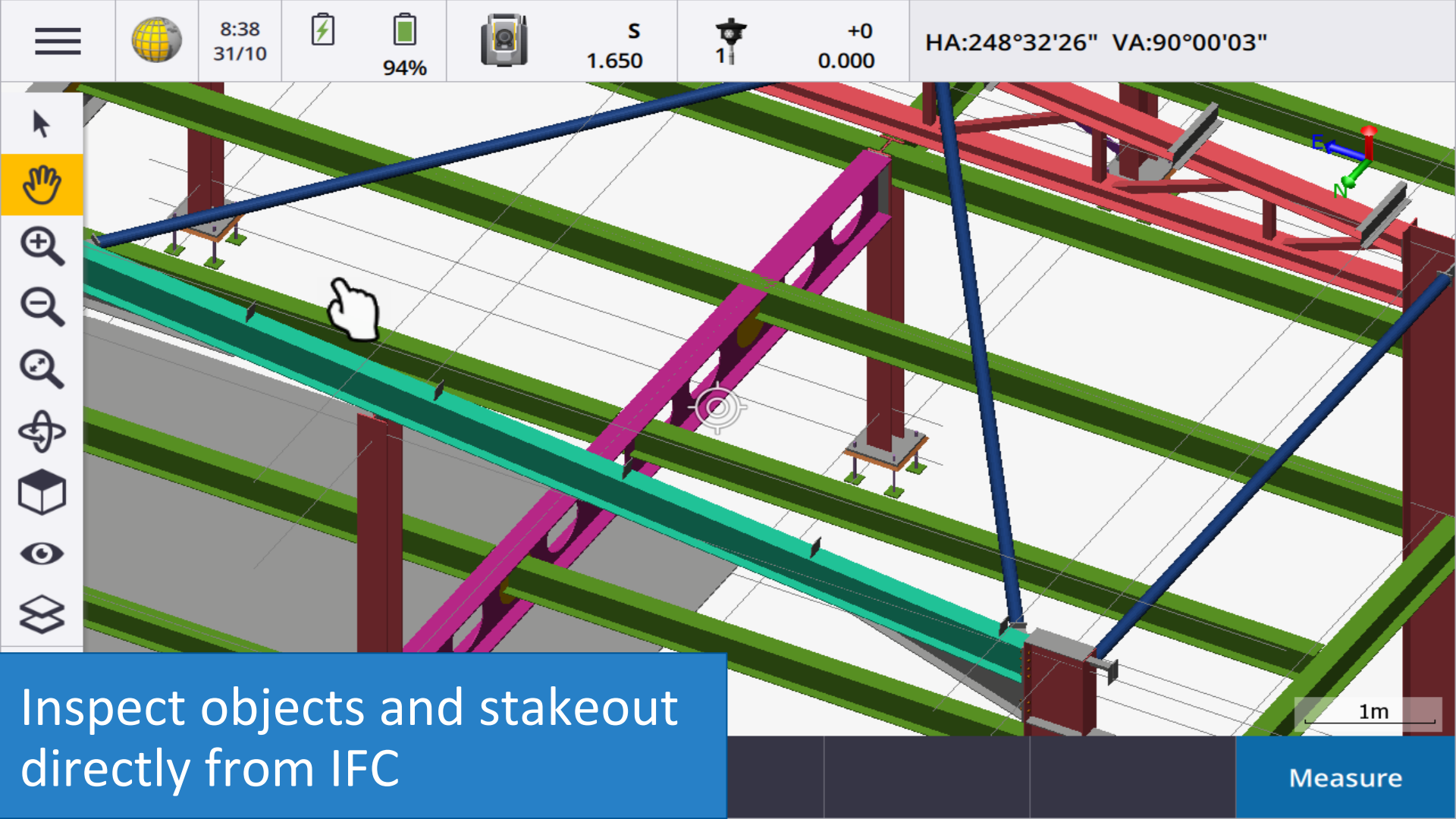

Unnamed - Trimble Business Center
File
Home
Survey
GIS
CAD
Drafting
Surfaces
Corridors
Point Clouds
Construction Data
Photogrammetry
Tunnels
Mobile Mapping
Data Prep
Takeoff
Site Mass Haul
Corridor Mass Haul
Utility
Drill Pile Compact
Macros
Support
Import
Export
Send to Sync
Open Remote File
Save File Remotely
Job Report Generator
Device Pane
Data Exchange
View Filter Manager
My Filter
Plan View
3D View
Top
Plane Manager
Cutting Plane View
Limit Box
Station View
Google Earth
History Log View
View
Project Explorer
Points
Occupation
Optical
Photo Point
Vector
Feature
Explore Object
Measure Distance
Data
Selection Explorer
Select Points
Select Duplicate Points
Select by Elevation
Select Observations
Select by Layer
Select Similar
Advanced Select
Invert Selection
Select All
Selection
Project Explorer
Unnamed
Points
Imported Files
IFC Tekla2.ifc
IFCCOLUMN
IFCBEAM
IFCMEMBER
IFCPLATE
IFCFOOTING
IFCREINFORCINGBAR
IFCSLAB
FOOTING
IFCMECHANICALFASTENER
Properties
IFCSLAB
FOOTING
IFCSLAB (1)
BIM Object
Name: FOOTING
Appearance
Visible: Yes
Color: 32, 202, 157
Layer
Layer: FOOTING
Show In Plan View
Wireframe: No
Vertices: No
Edges: Yes
Show In 3D View
Wireframe: No
Vertices: No
Edges: Yes
Summary
Volume: 1.4 m³
Number of triangles: 12
Number of vertices: 8
Property
Import file: IFC Tekla2.ifc
Plan View [My Filter]
3D View [My Filter]
Snap
Meter
Grid
Default
View and prepare data inside
Trimble Business Center

Robotic Total Station Layout

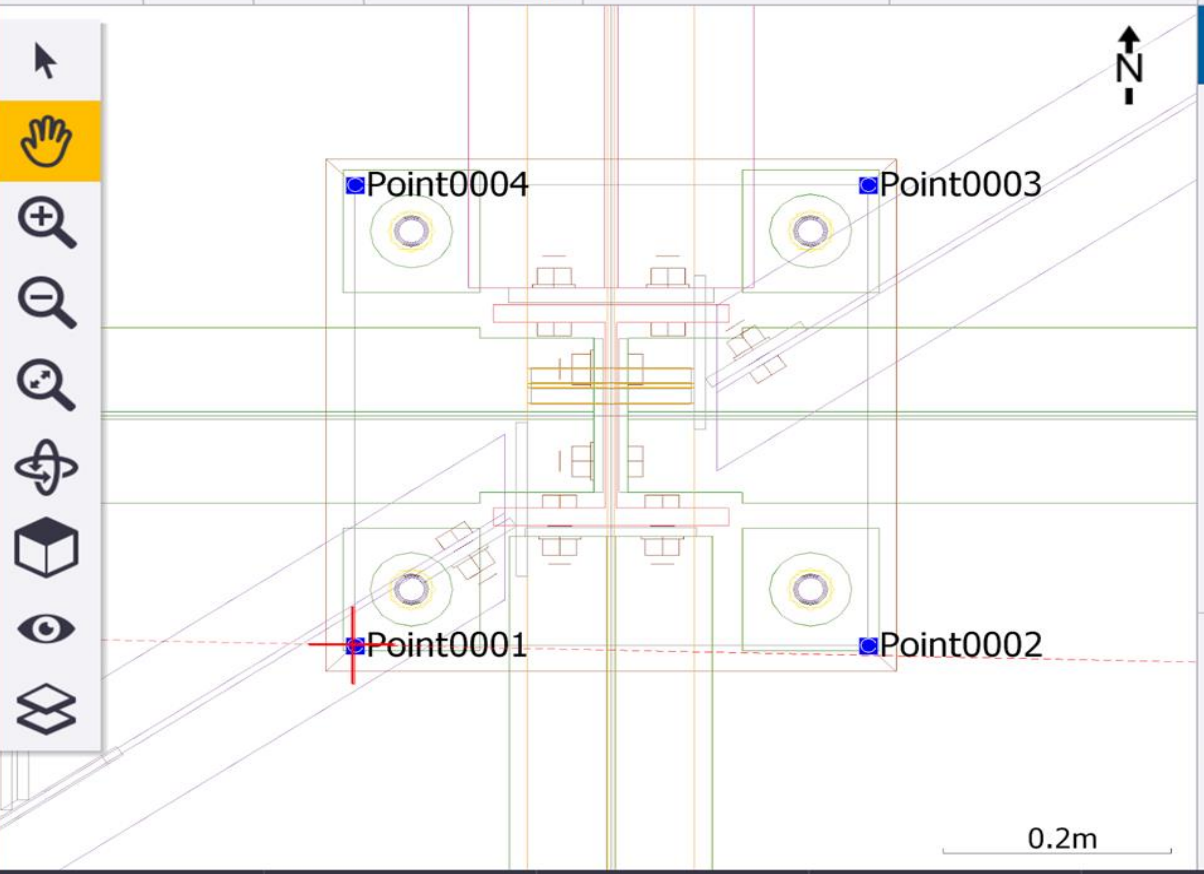




Trimble TSC7: Big Screen – Giant Potential

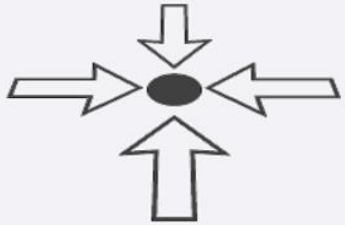


Inspect objects and stakeout directly from IFC

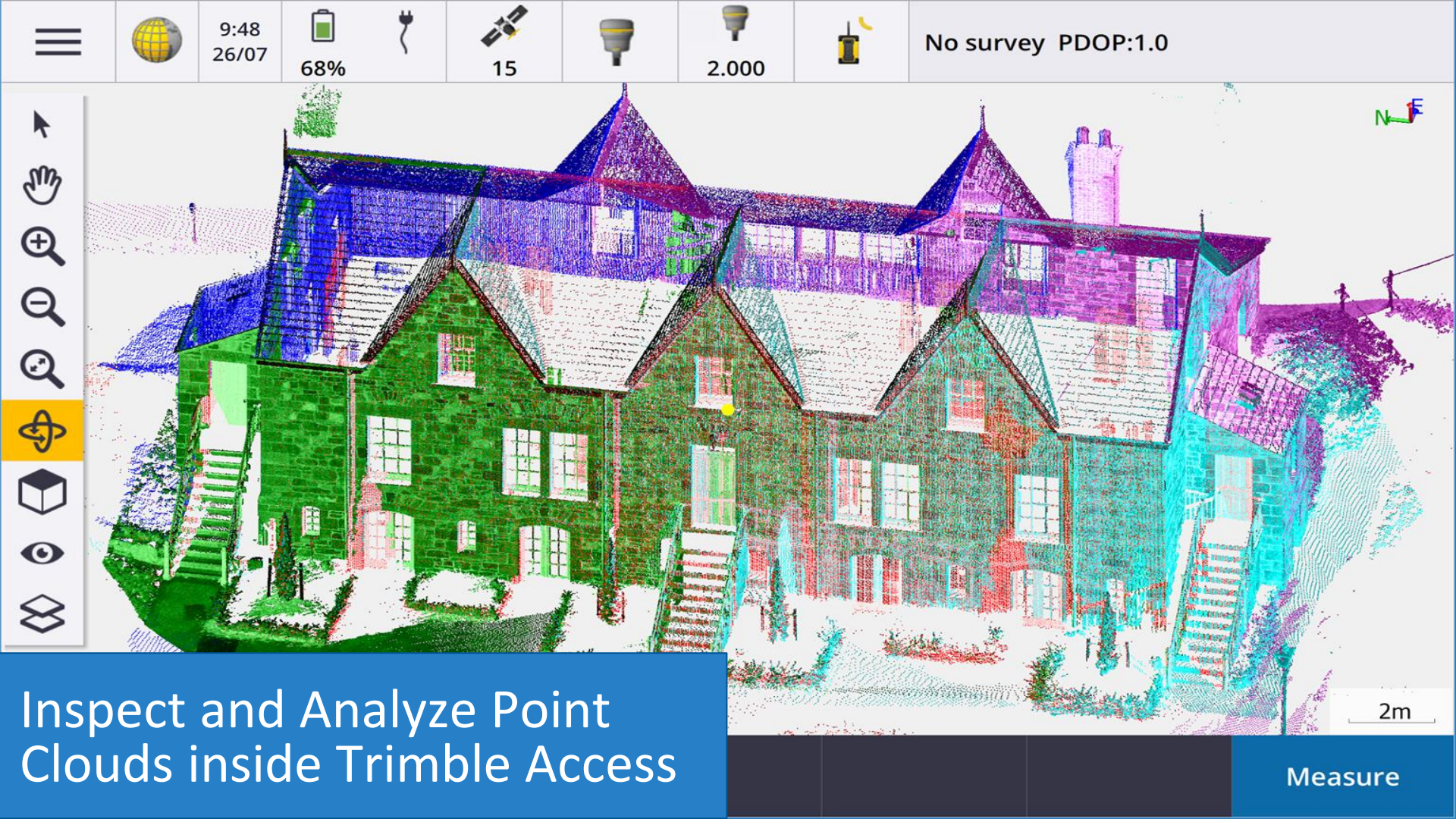


Stake out point F4

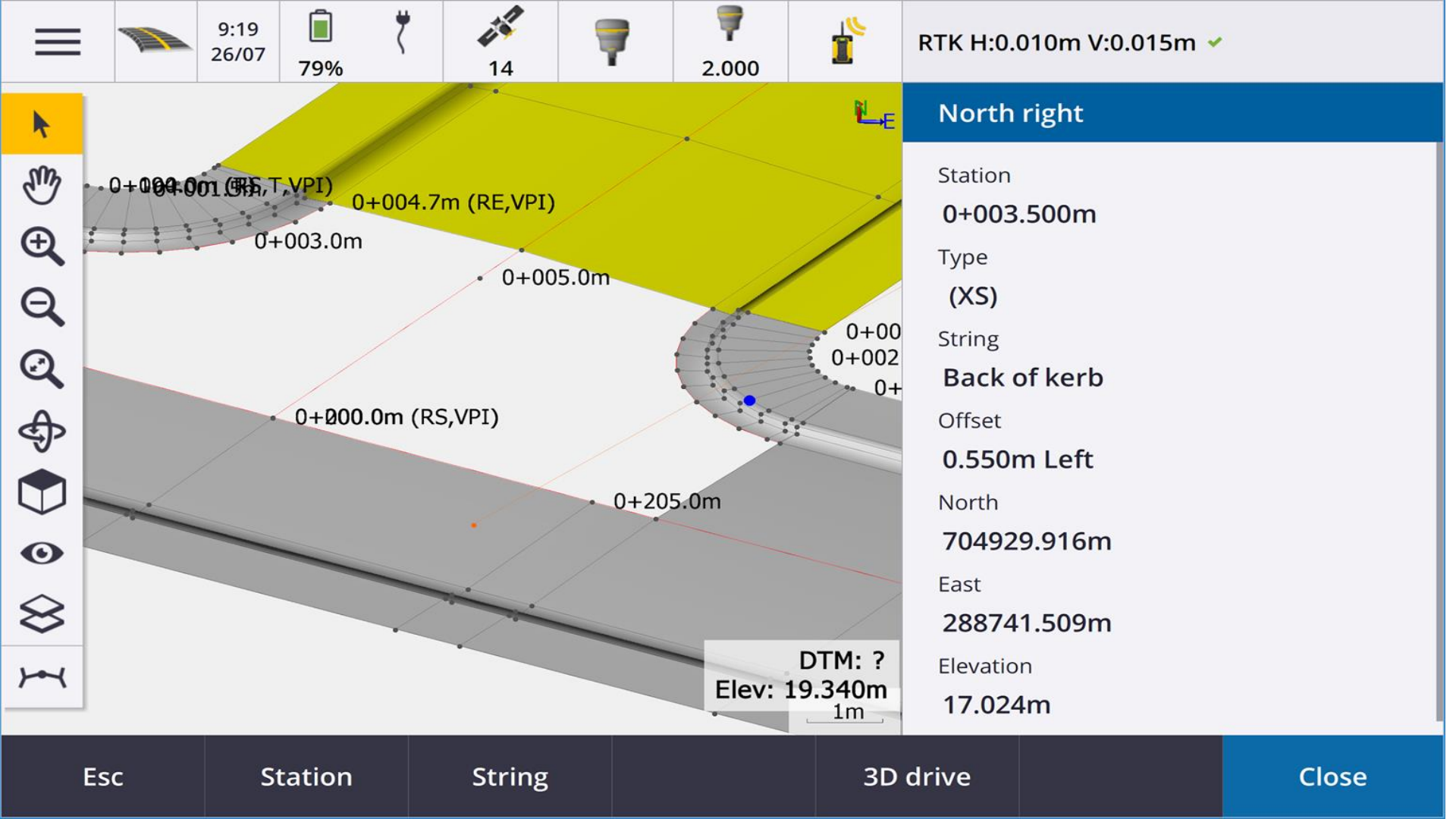
Point: Point0001



Go Out	H.Ang reqd.
0.002m	**92°01'17"**
Go Right	Delta H.Ang
0.001m	**0°00'17"**
V.Dist	Design elevation
Cut 0.000m	**0.000m**

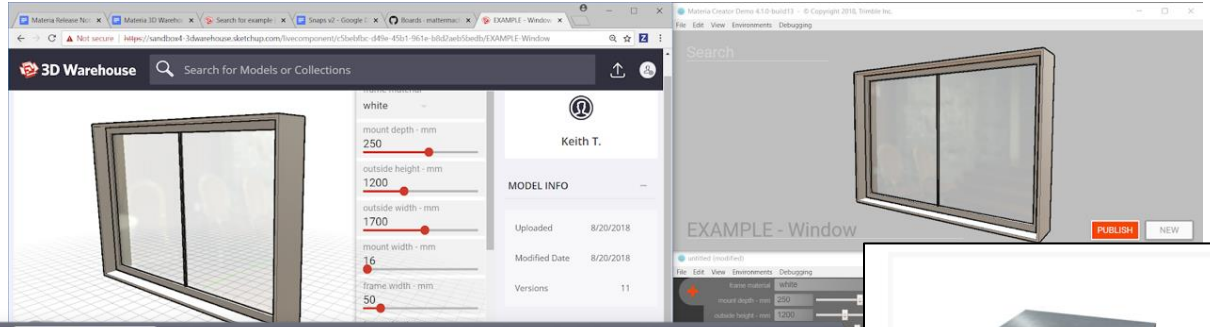


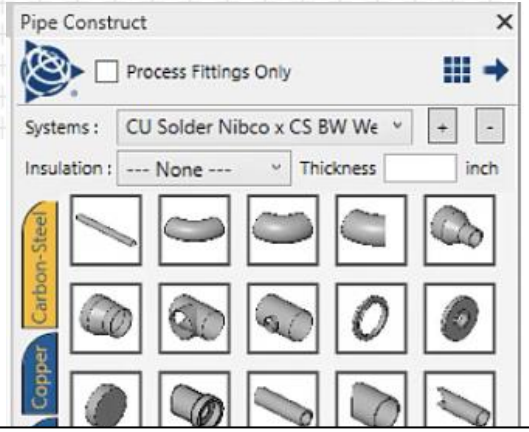
Inspect and Analyze Point Clouds inside Trimble Access

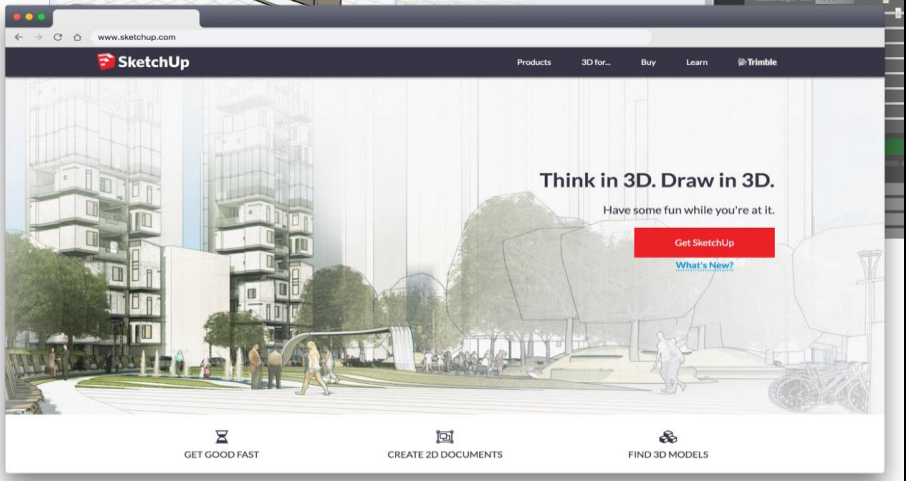

9:19
26/07
79%
14
2.000
RTK H:0.010m V:0.015m
North right
Station
0+003.500m
Type
(XS)
String
Back of kerb
Offset
0.550m Left
North
704929.916m
East
288741.509m
Elevation
17.024m
0+004.7m (RE,VPI)
0+003.0m
0+005.0m
0+200.0m (RS,VPI)
0+205.0m
DTM: ?
Elev: 19.340m
1m
Esc
Station
String
3D drive
Close

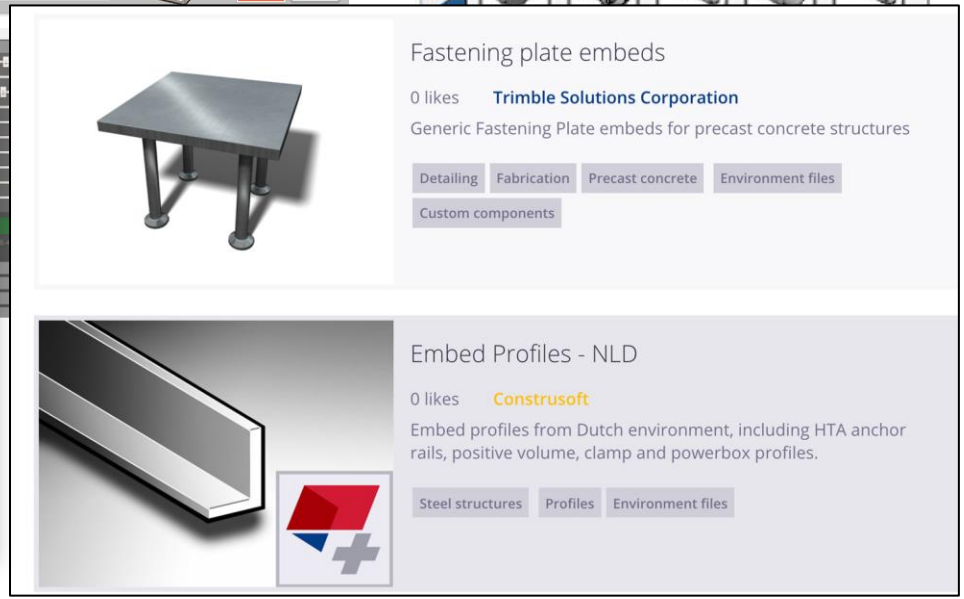
Content-enabled

Data attribution is fueling digital transformation



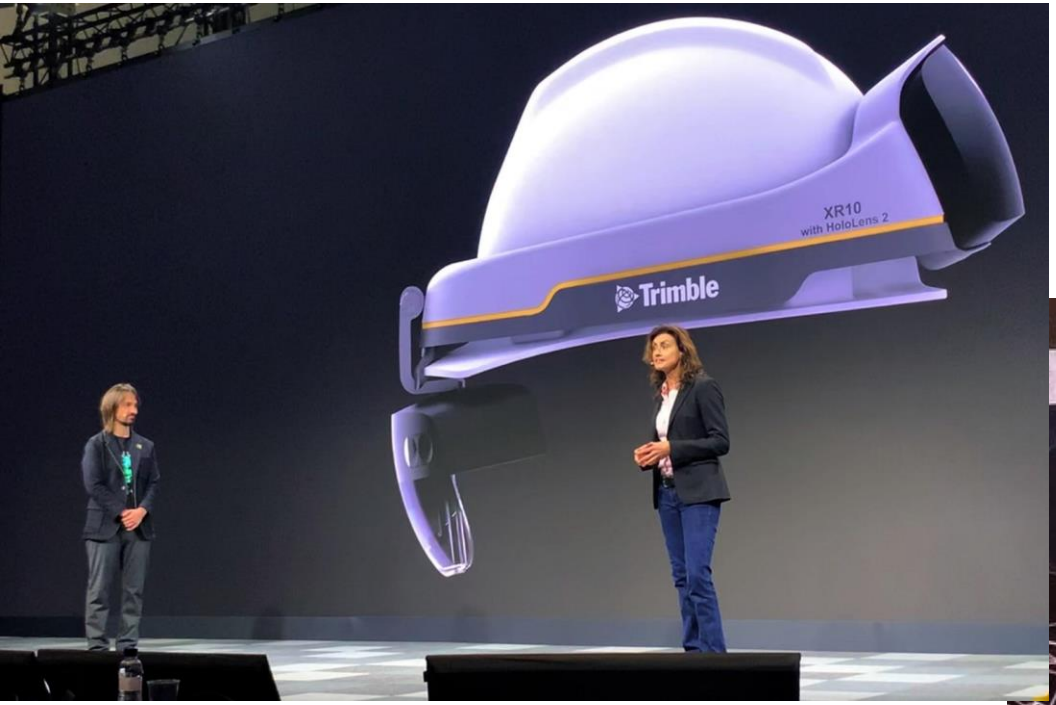






Visualize and Collaborate with Trimble Hololens

Trimble XR10 With Microsoft Hololens 2



Visualize Existing Conditions – Trimble Site Vision

Trimble | SiteVision

Trimble

CONSTRUCTIBLE
CONFIDENCE
CONTENT-ENABLED

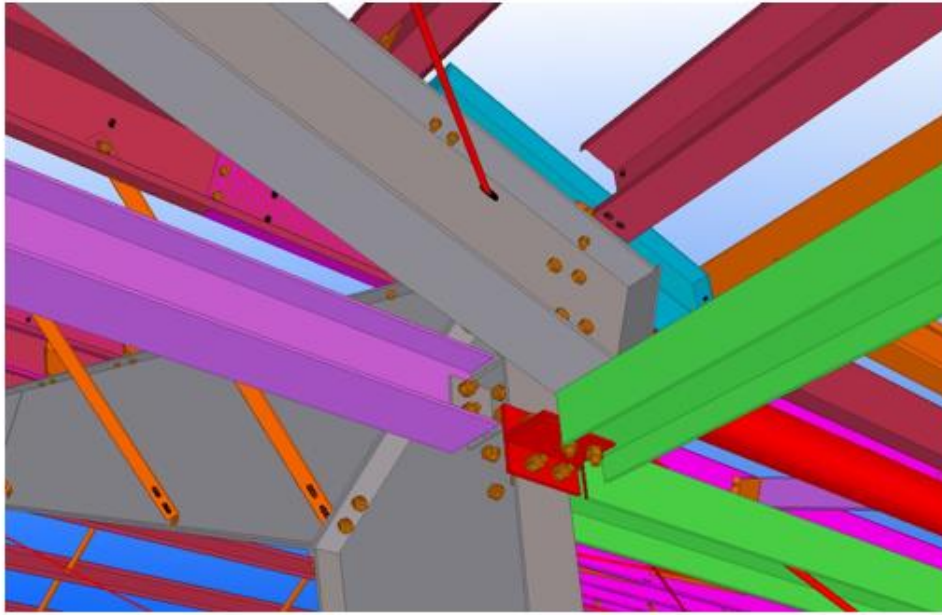
Thank You !

Trimble

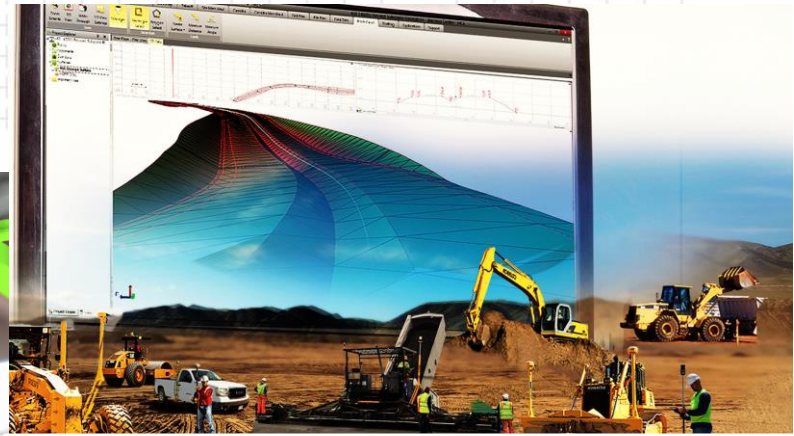
boris_skopljak@trimble.com
+1 720 491 2592

Constructible

Precise, constructible models, so accurate you can build from it



Share and Visualize



So Accurate You Can Build From It