Revolutionizing Road Infra with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines

February 29th - March 1st, 2024, Manekshaw Centre, New Delhi

GIS & AI Based Project Monitoring

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Trimble

International Road Federation
India Chapter

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Why Digital Construction?

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

Complexity

Complex projects; fragmented workflows & supply chain

85% Projects exceed **budget**

63% Projects have **quality** issues

92% Projects exceed **schedule**

40% of jobsite work **unproductive**

People

Skilled labor is a top priority

90% Face **Talent** Shortages

30% Decrease in **Workers** Less than 24 Years Old

Profit Fade

Maintaining profitabilty

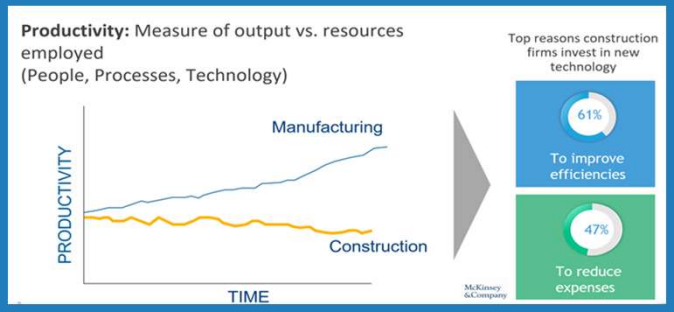
4-5 % Average project margins

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.

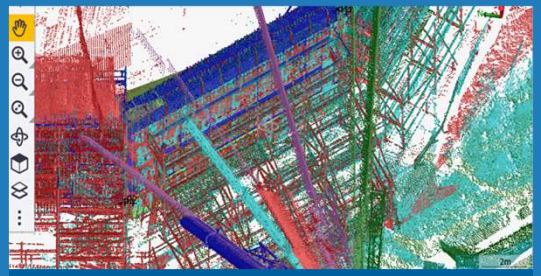


Sources: McKinsey, Dodge Analytics, US Chamber of Commerce Commercial Construction Index, Construction Financial Management Association, IBISWorld, Byggeindustrien Norway. 'Projects' refers to construction projects.

Digital Construction

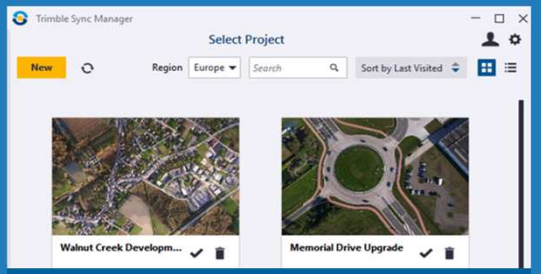
Physical to Digital

Digitization of Existing Conditions through a use of rich survey data.
Efficient feasibility planning, conceptual and detailed design



Digital to Physical

Consistent model use supporting field stakeout, inspection, analysis with connection back to the constructible model



Collaboration and Connectivity

Trimble Connect

Common data environment to streamline data sharing, collaboration and decision making

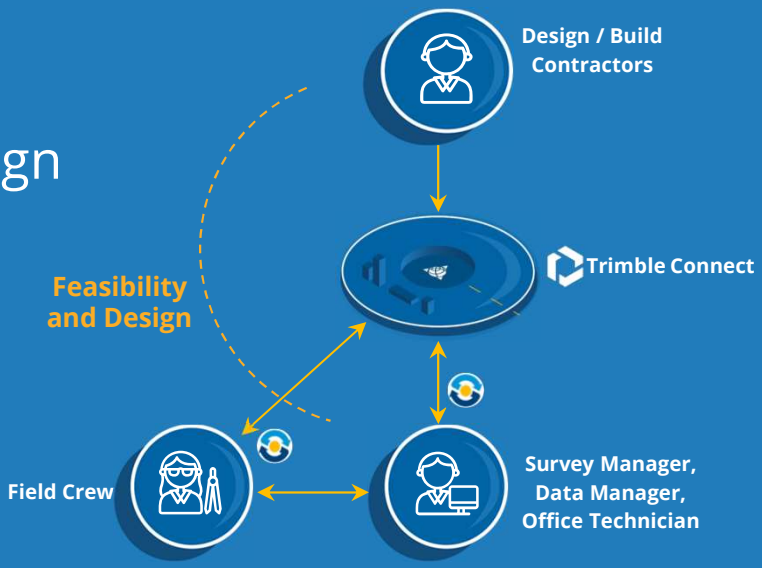
Integrated Vertical Workflows

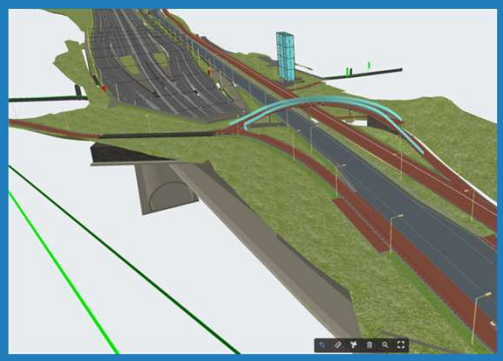

Trimble Workflow
1 Plan work ahead
Construction activities and field survey tasks
2 Send from office to field
Prepare and send design data from the office to the field
3 Collect survey data in the field
Create preliminary report
4 Securely store field data in the cloud
5 Process & prepare final deliverables in the office
6 Share deliverables digitally & Win more business
Stay “at the table” and continue creating value by providing additional data and services as they are required by the client
7 Update project status to help track progress
Store completion status per construction object, based on field data / deliverables report

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



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Legend
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sbet_Mission 1_200Hz.gps
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3D Map
Relief Scale Factor:
Legend
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LEVELCURVES
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LAS Density 100 %
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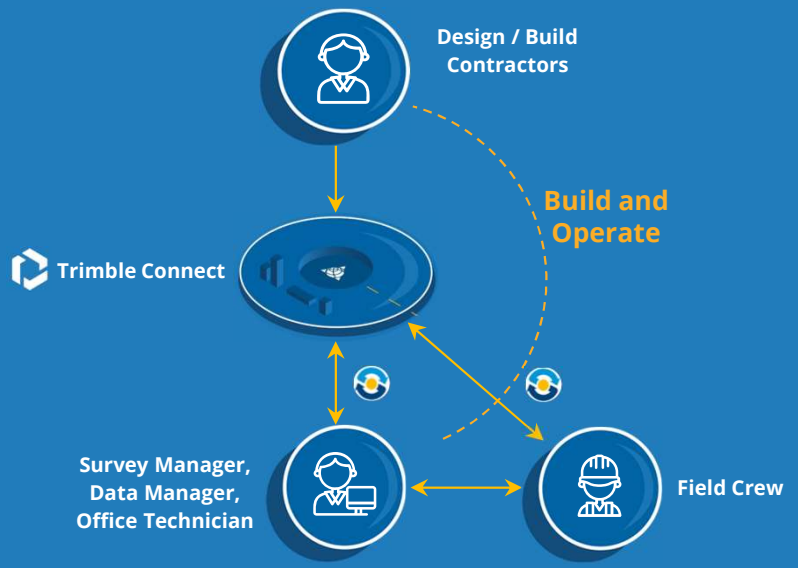
ROI H: 28.544 L: 1366.197 W: 251.986

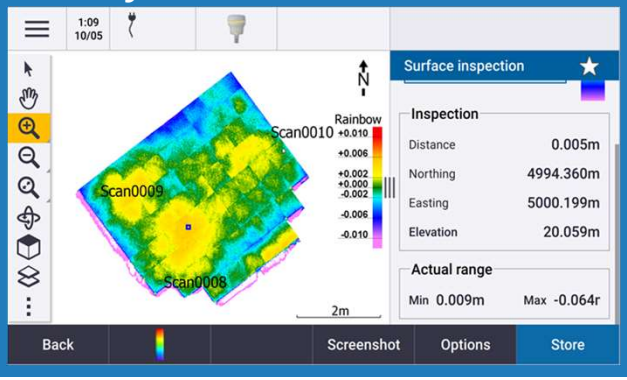
Digital to Physical

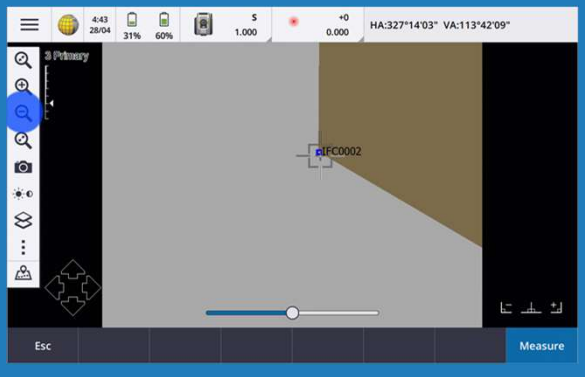
Streamlining design to field workflows

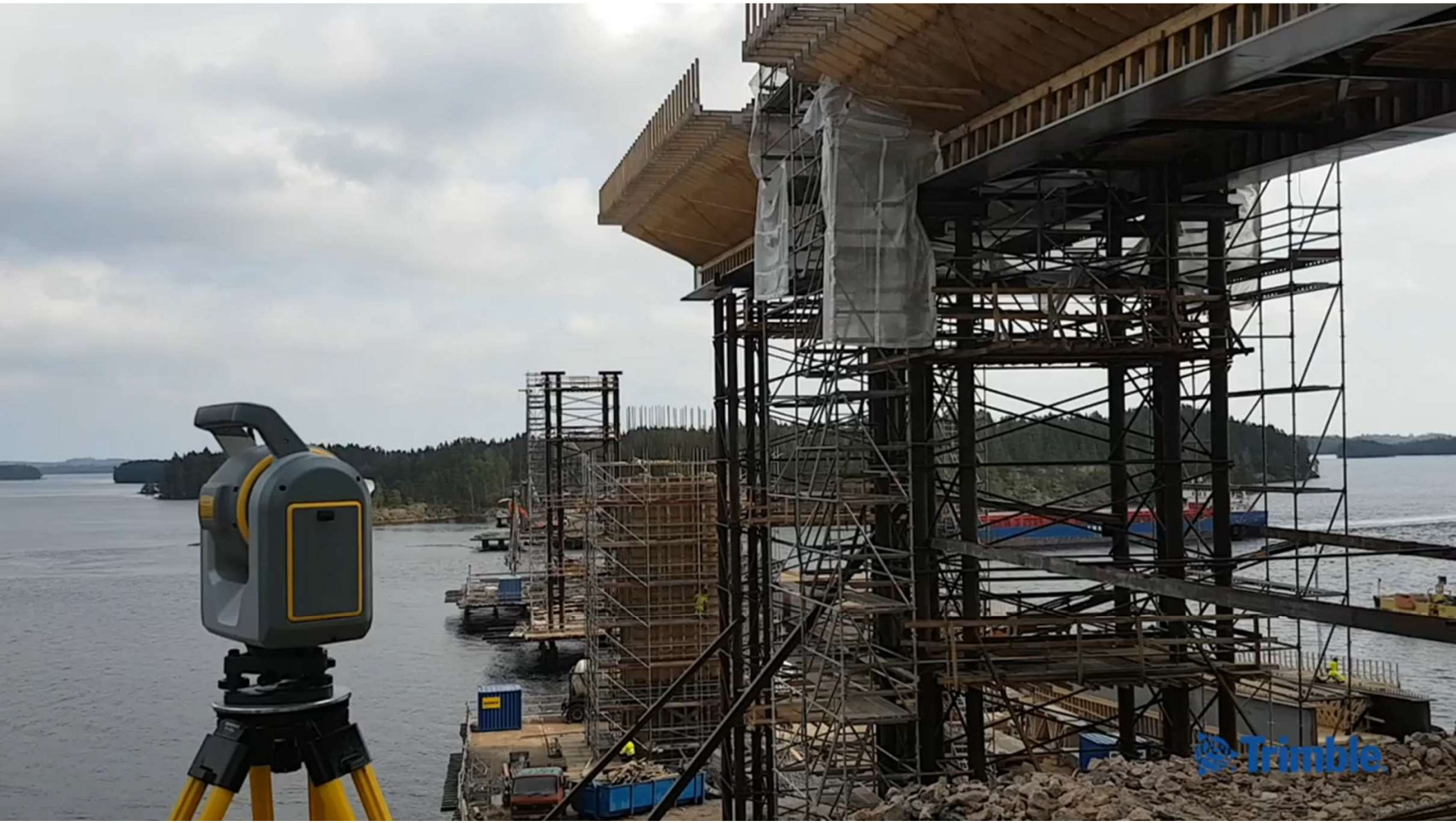
As-built inspection

- 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)

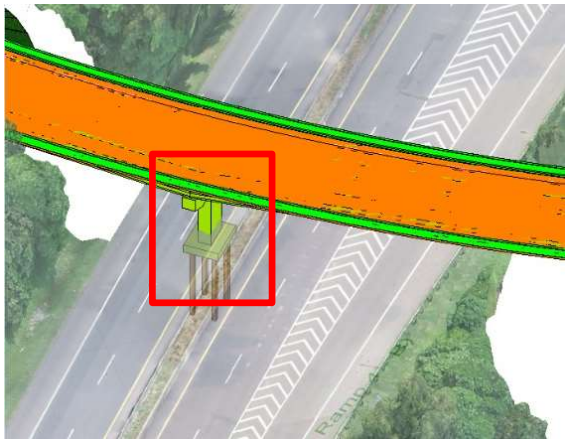




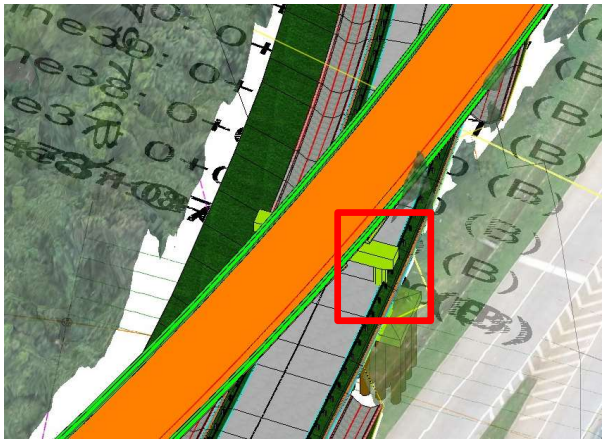



Trimble

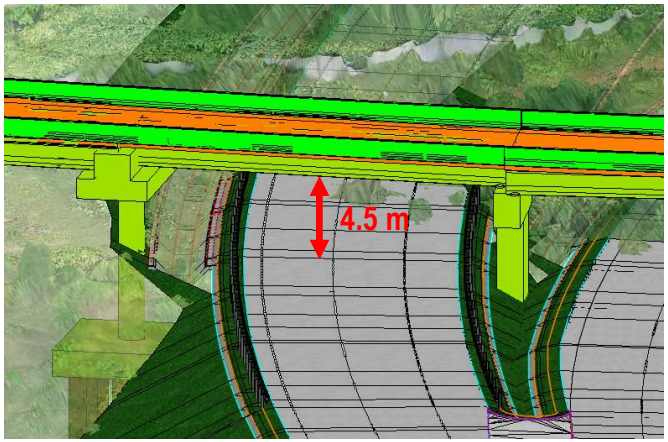
SUPERIMPOSED MODELLING



Pier misplaced on existing road



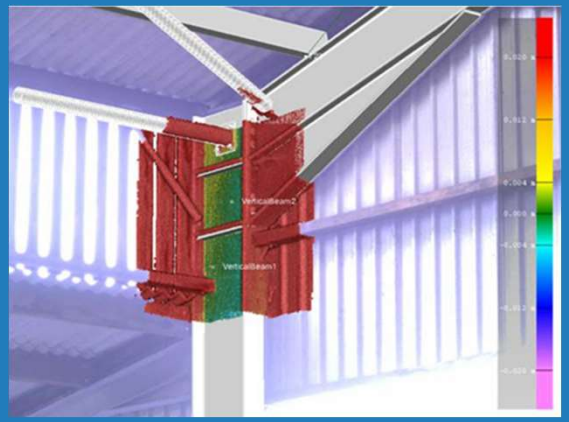
Pier misplaced on ramp

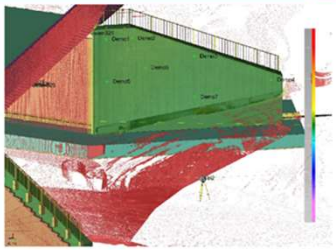


Road clearance doesn't meet the requirement

Scan Inspections

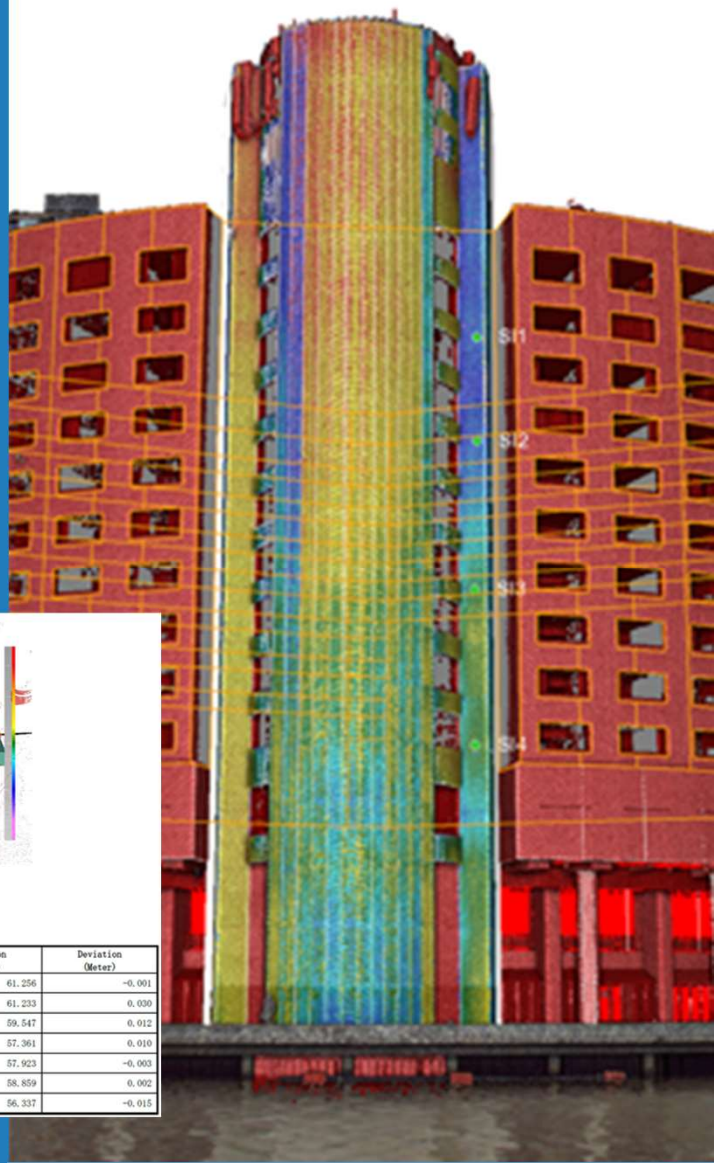
- **Scan-scan + Scan-model analysis** (IFC, TRB, Meshes and surfaces)
- Reporting deviations/deltas





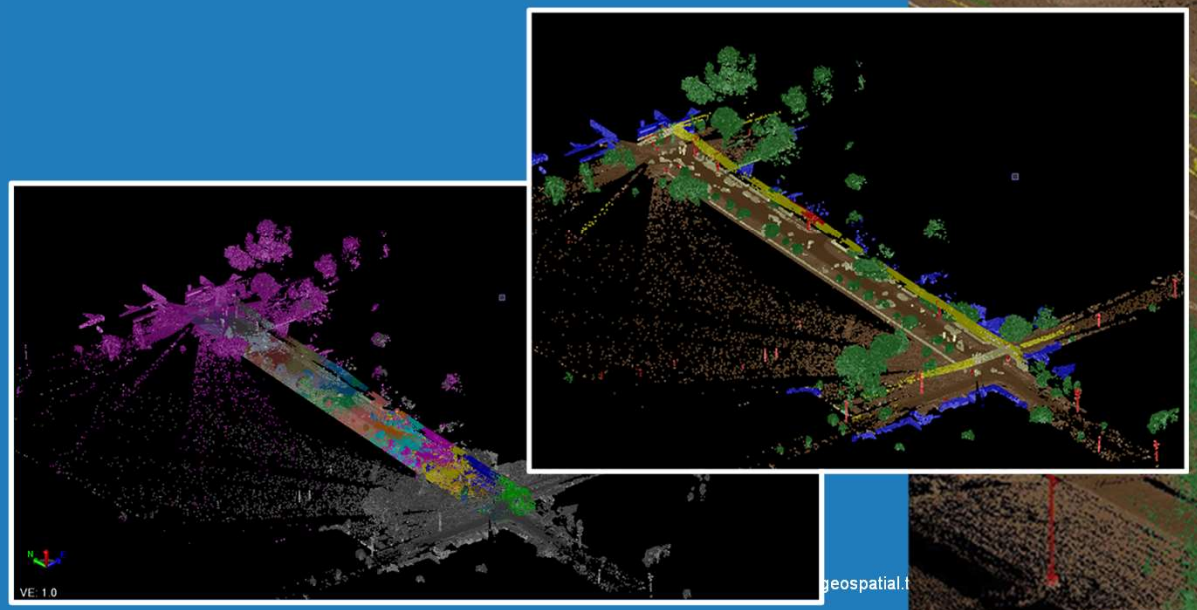
Scan Inspection Report

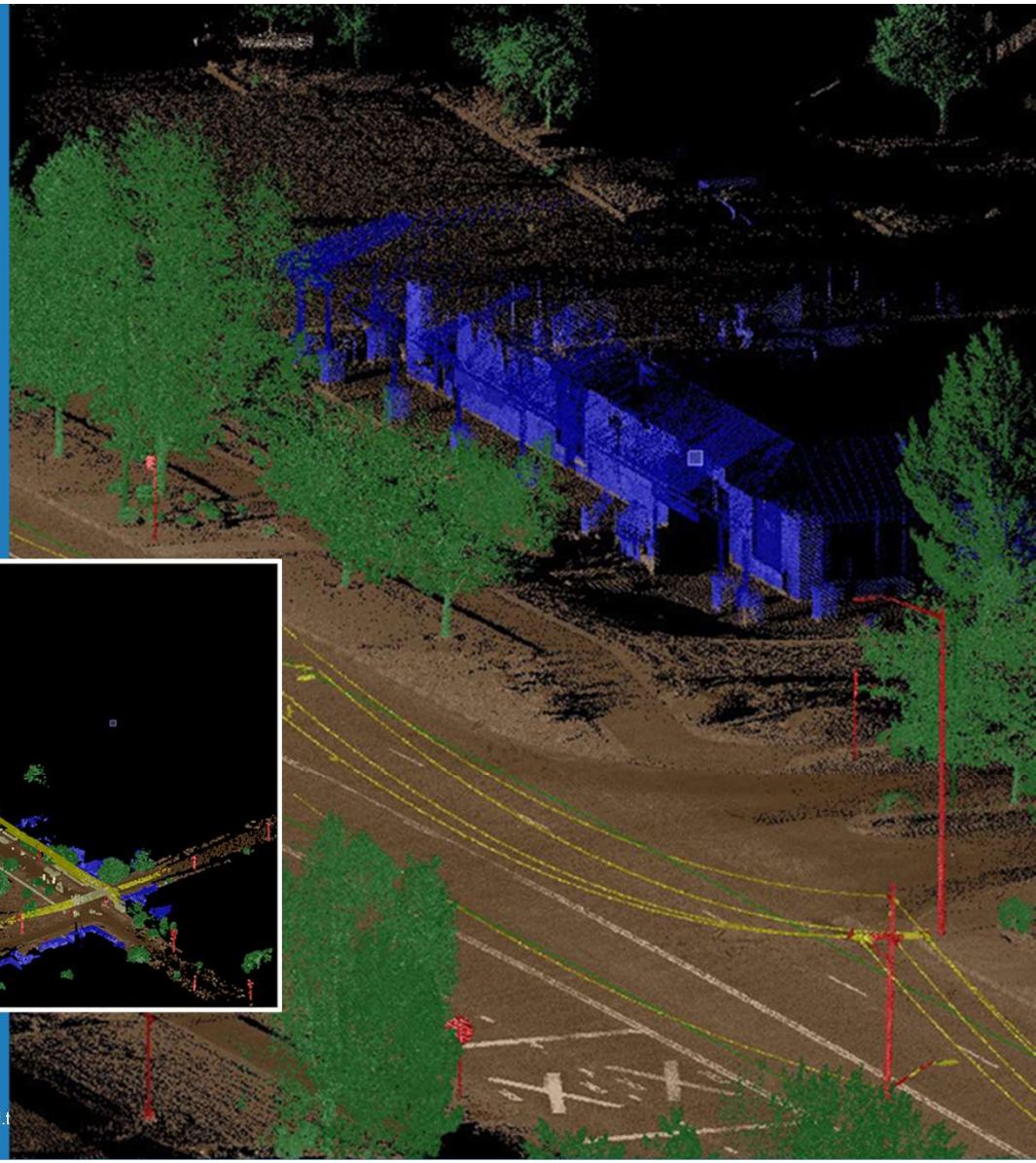
ID	Northing (Meter)	Easting (Meter)	Elevation (Meter)	Deviation (Meter)
Demo1	296781.469	265548.661	61.256	-0.001
Demo2	296782.182	265546.899	61.233	0.030
Demo3	296783.803	265542.644	59.547	0.012
Demo4	296785.843	265537.352	57.361	0.010
Demo5	296781.494	265548.592	57.923	-0.003
Demo6	296782.505	265545.982	58.859	0.002
Demo7	296783.791	265542.602	56.337	-0.015



Automatic Classification

- Buildings
- Ground
- High/Medium Vegetation
- Poles and signs
- Power lines
- Dividers
- Steps





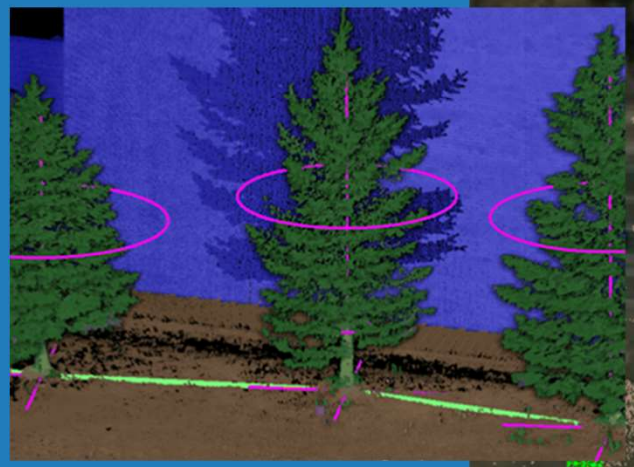
Feature Extraction

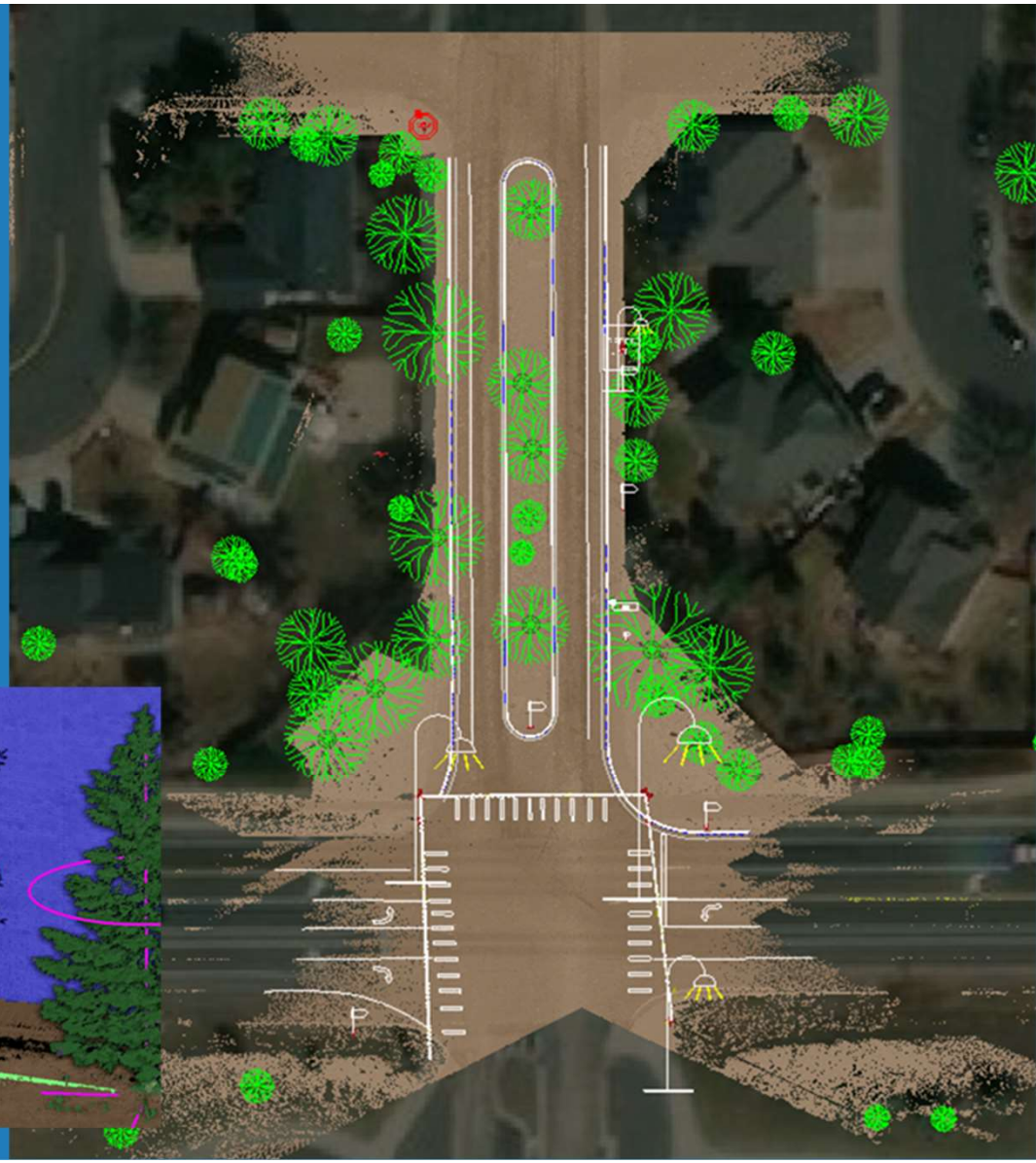
Line Features

- Overhead Line
- Curb and Gutter
- Lane Lines

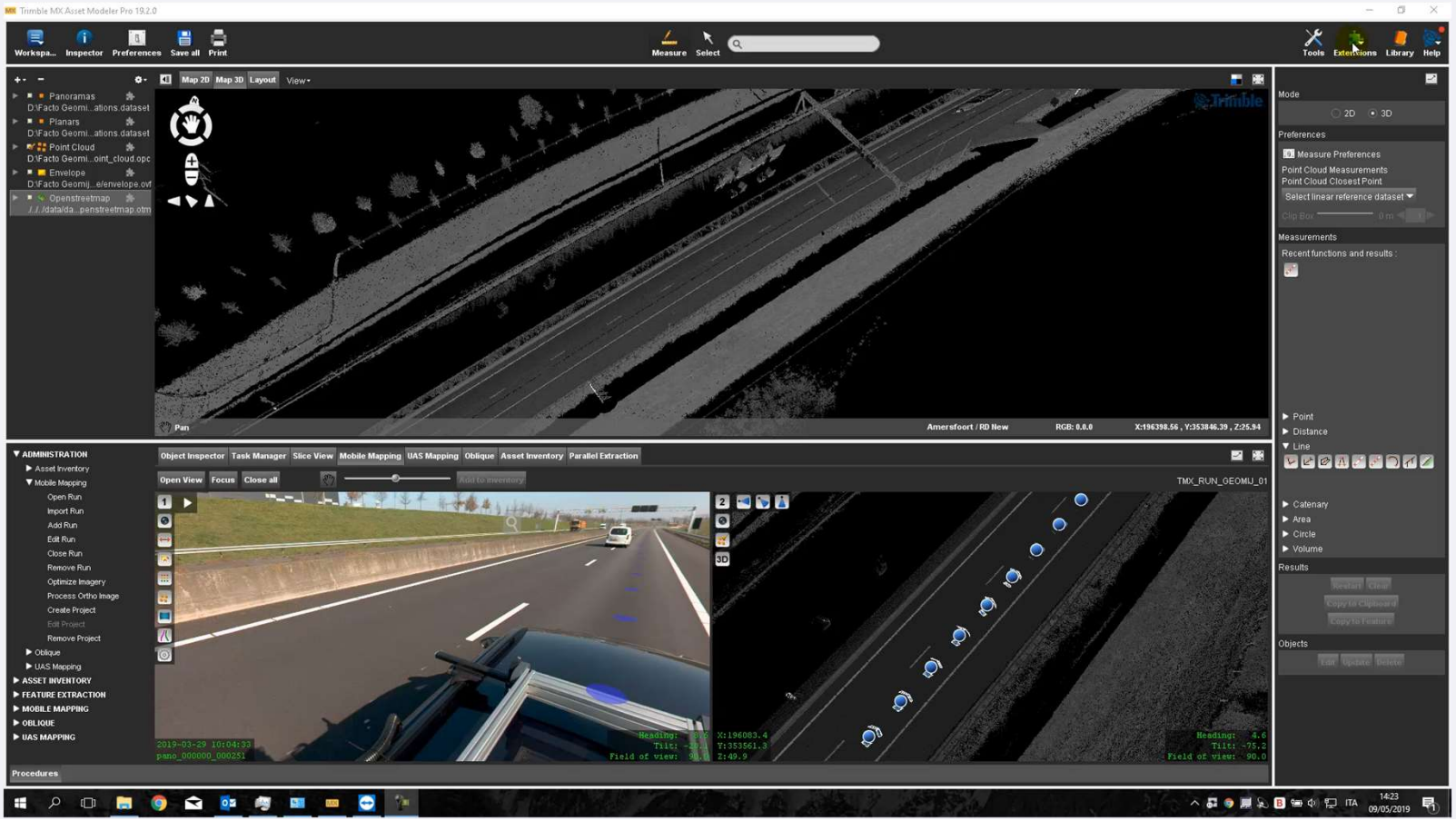
Point Features

- Tree
- Pole
- Sign
- Manholes



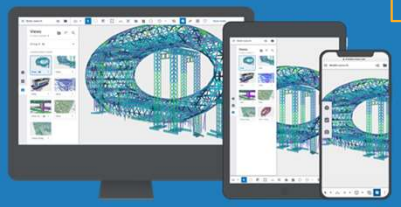


Feature Extraction



Connecting the field-office-stakeholders

Stakeholder



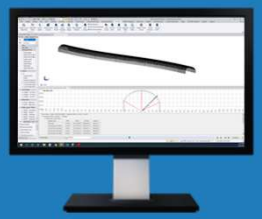
Data Transfer

Trimble Connect®

Data Transfer

Office technician

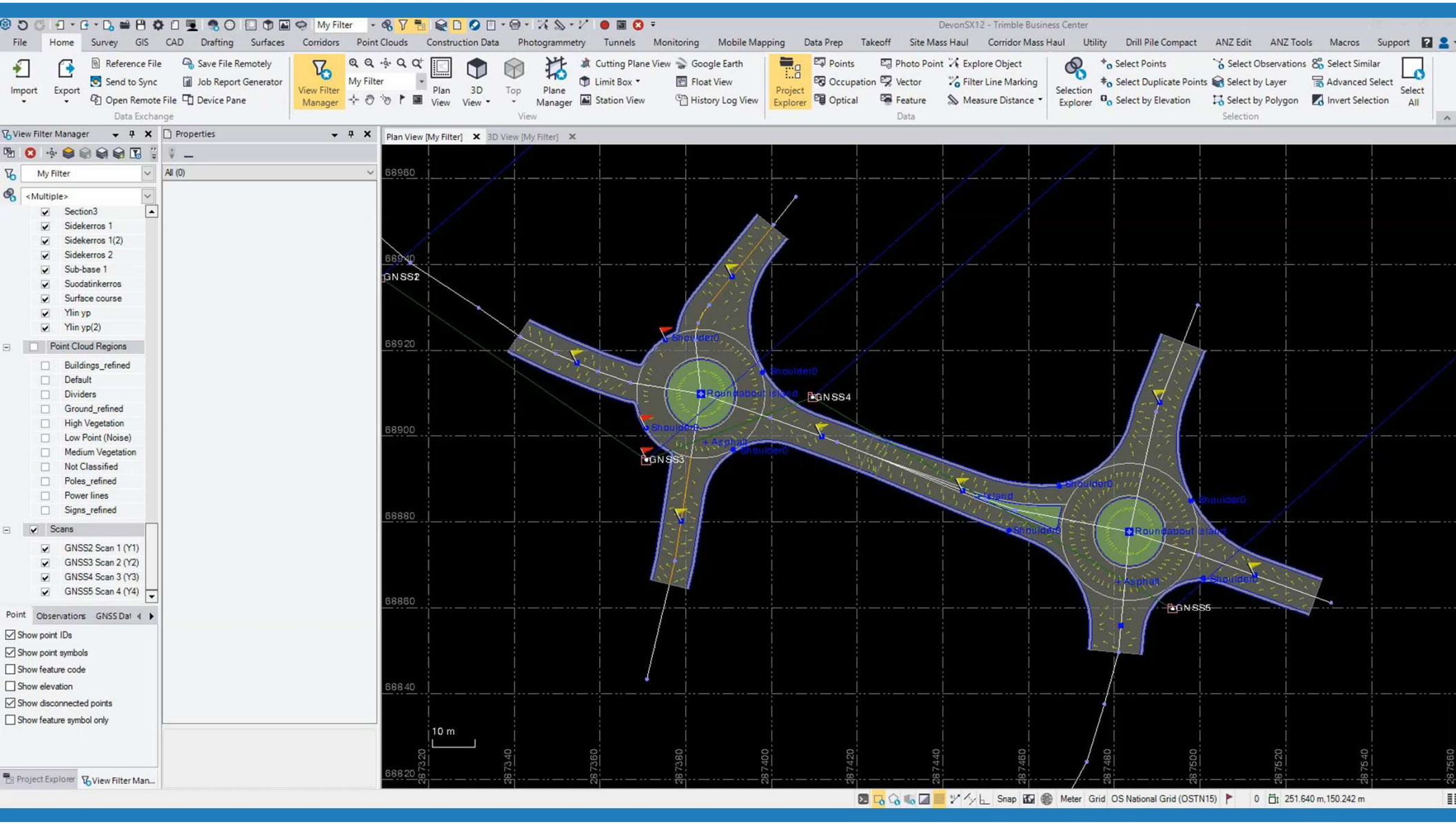
Field crew



Trimble Business Center

Field & design data

Trimble Access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GIS
CAD
Drafting
Surfaces
Corridors
Point Clouds
Construction Data
Photogrammetry
Tunnels
Monitoring
Mobile Mapping
Data Prep
Takeoff
Site Mass Haul
Corridor Mass Haul
Utility
Drill Pile Compact
ANZ Edit
ANZ Tools
Macros
Support
Import
Export
Reference File
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
Float View
History Log View
View
Project Explorer
Points
Occupation
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Feature
Explore Object
Filter Line Marking
Measure Distance
Data
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Select Points
Select Duplicate Points
Select by Elevation
Select Observations
Select by Layer
Select by Polygon
Select Similar
Advanced Select
Invert Selection
Select All
Selection
View Filter Manager
My Filter
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Sidekerros 1(2)
Sidekerros 2
Sub-base 1
Suodatinkerros
Surface course
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Ylin yp(2)
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Default
Dividers
Ground_refined
High Vegetation
Low Point (Noise)
Medium Vegetation
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Power lines
Signs_refined
Scans
GNSS2 Scan 1 (Y1)
GNSS3 Scan 2 (Y2)
GNSS4 Scan 3 (Y3)
GNSS5 Scan 4 (Y4)
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Observations
GNSS Dat
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Show point symbols
Show feature code
Show elevation
Show disconnected points
Show feature symbol only
Properties
All (0)
Plan View [My Filter]
3D View [My Filter]
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68940
68920
68900
68880
68860
68840
68820
GNSS2
GNSS3
GNSS4
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Island
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Snap
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Grid
OS National Grid (OSTN15)
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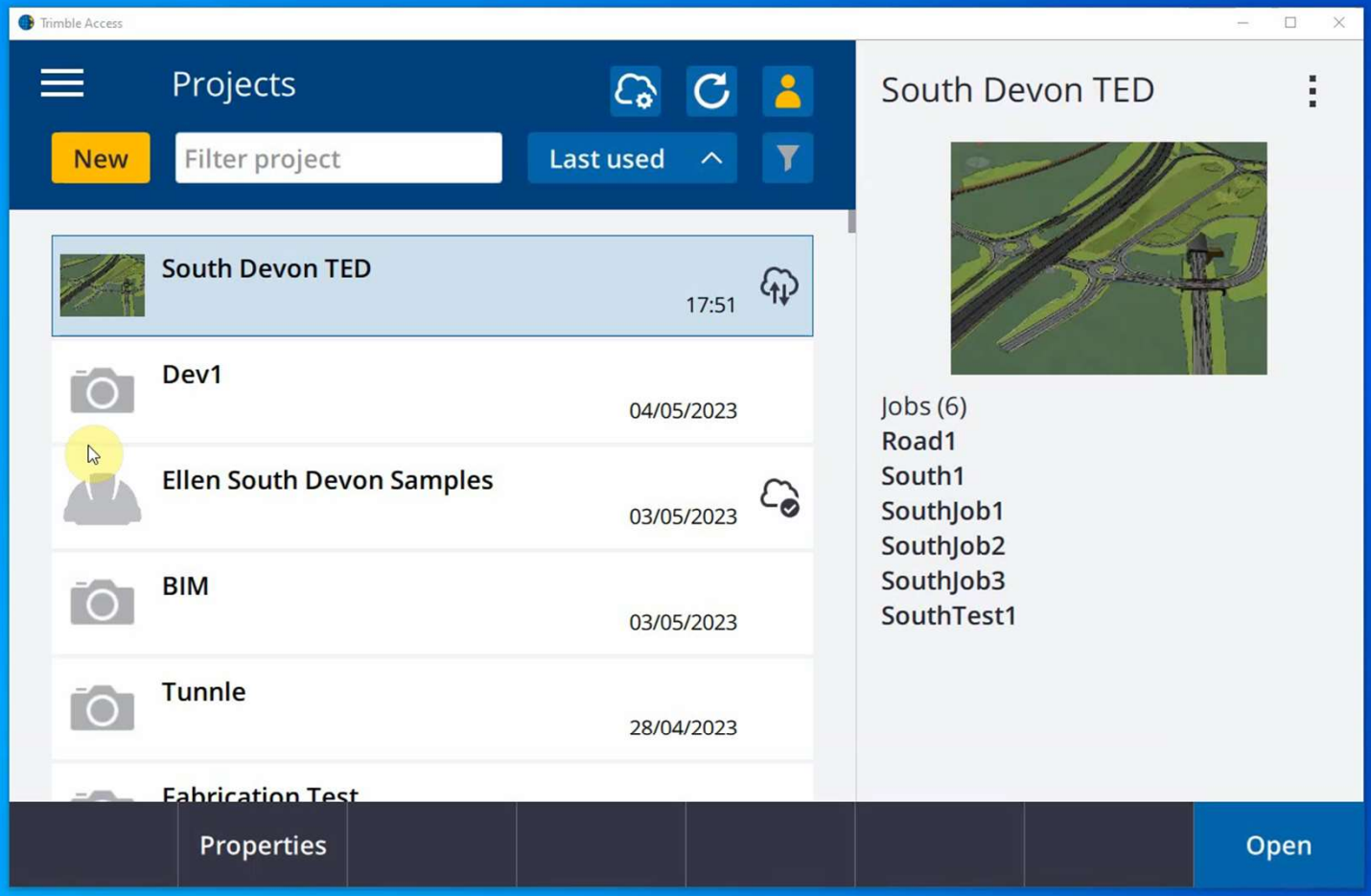
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Ellen South Devon Samples
03/05/2023
BIM
03/05/2023
Tunnle
28/04/2023
Fabrication Test
South Devon TED
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SouthJob2
SouthJob3
SouthTest1
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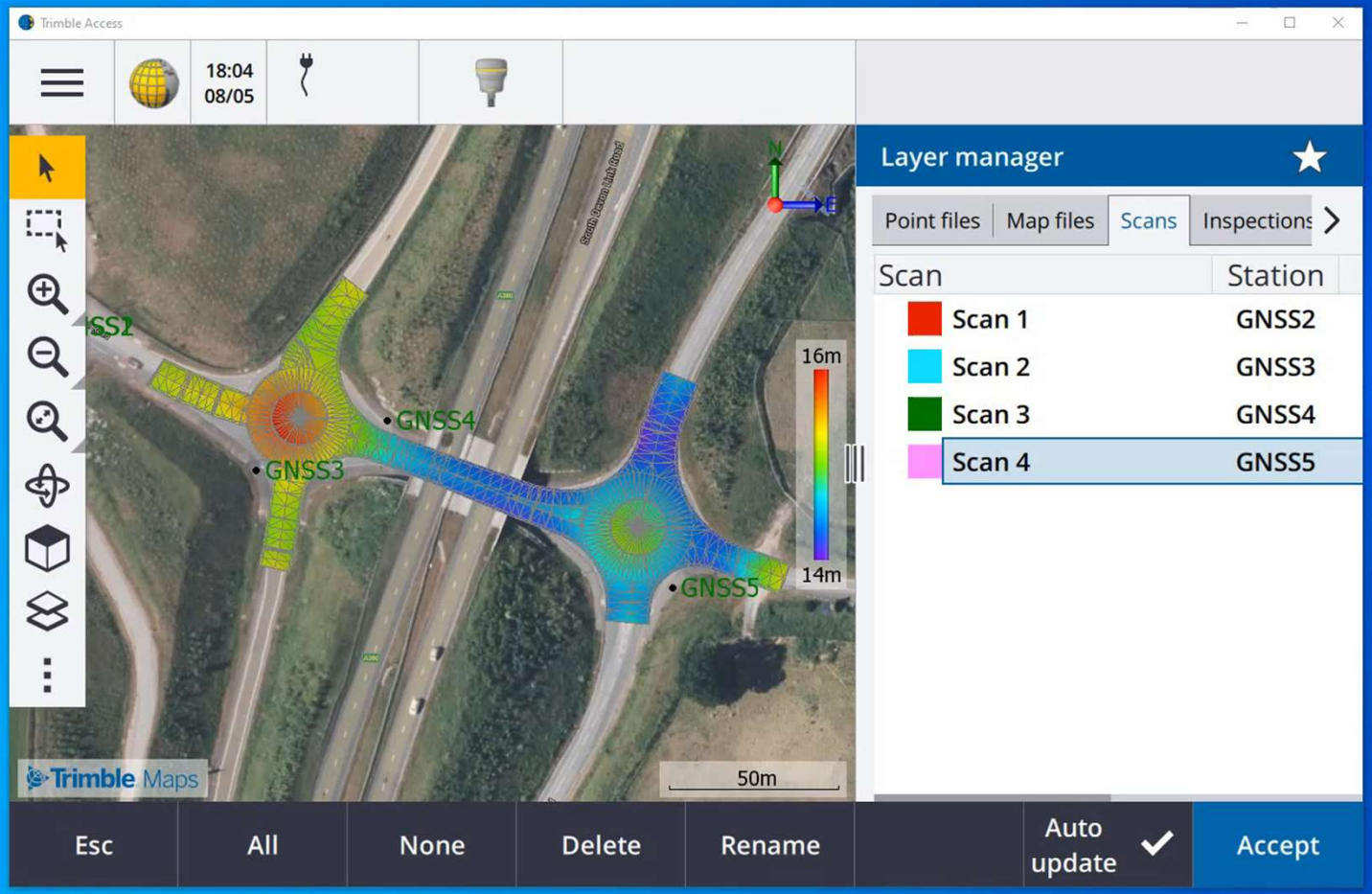
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Scan 2
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Scan 3
GNSS4
Scan 4
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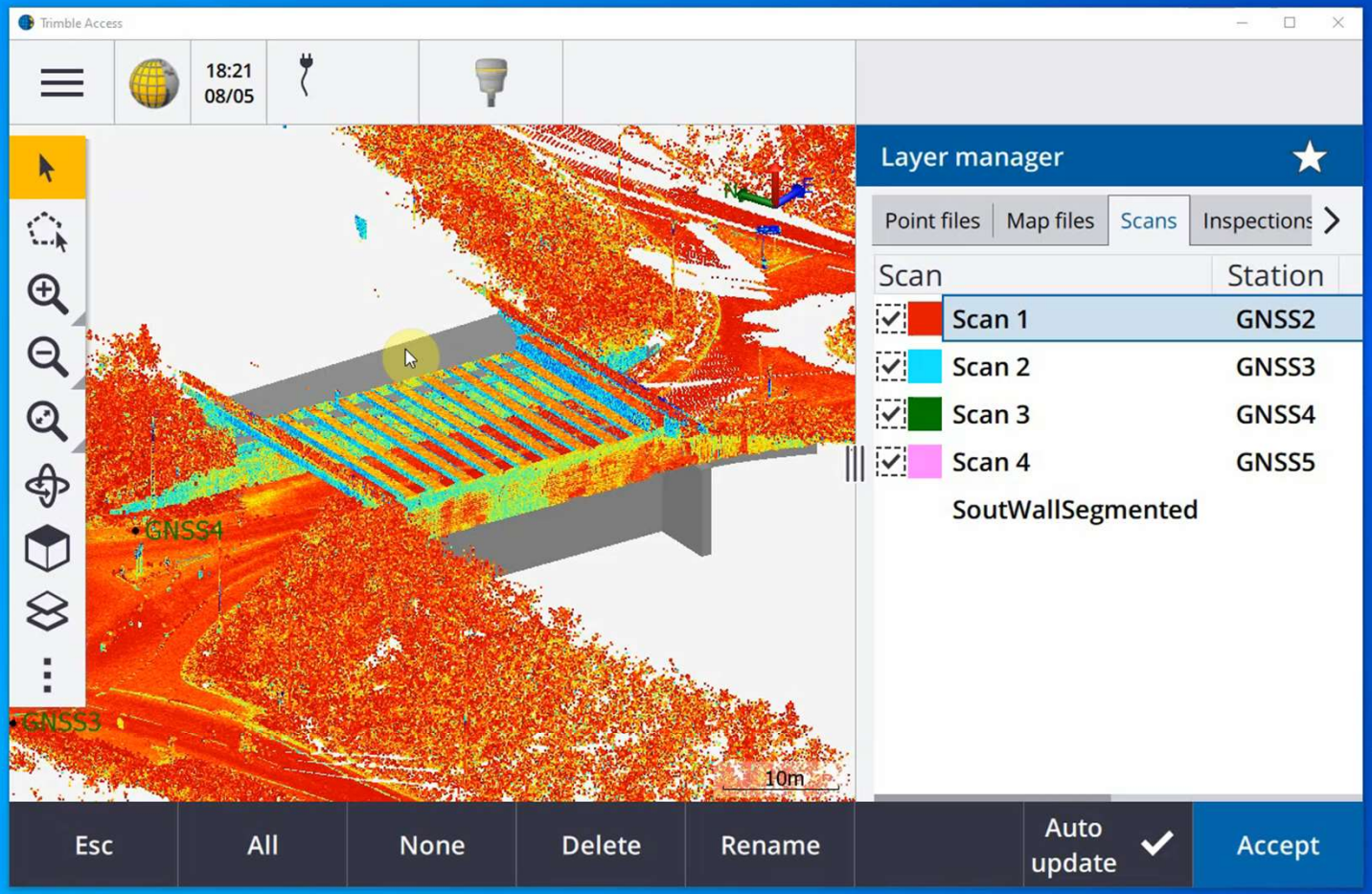
Rename
Auto update
Accept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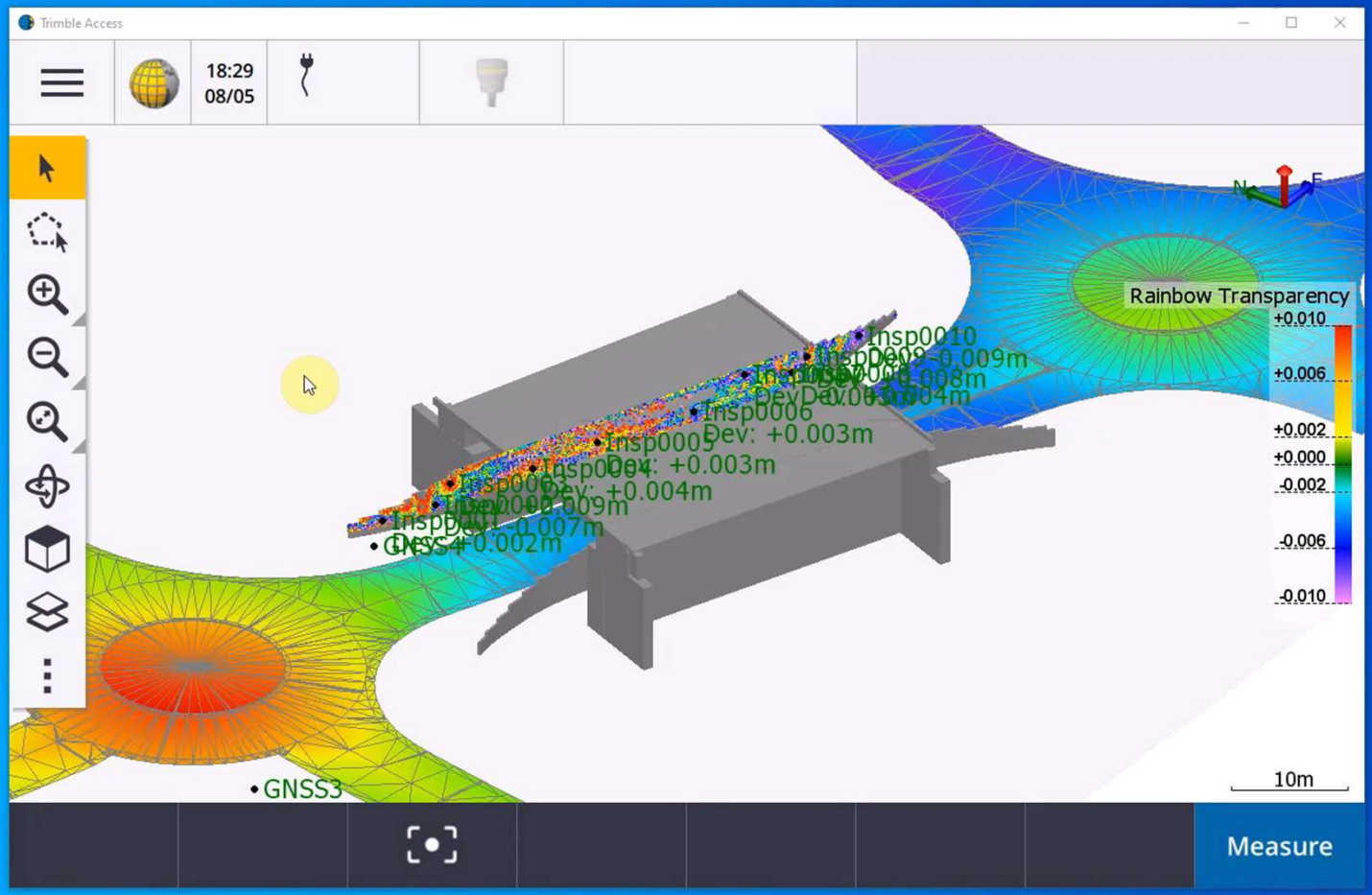
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08/05
Rainbow Transparency
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+0.006
+0.002
+0.000
-0.002
-0.006
-0.010
Insp0010
Dev: +0.009m
Insp0009
Dev: +0.008m
Insp0008
Dev: +0.004m
Insp0006
Dev: +0.003m
Insp0005
Dev: +0.003m
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Dev: +0.004m
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Insp0001
GNSS4
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GNSS3
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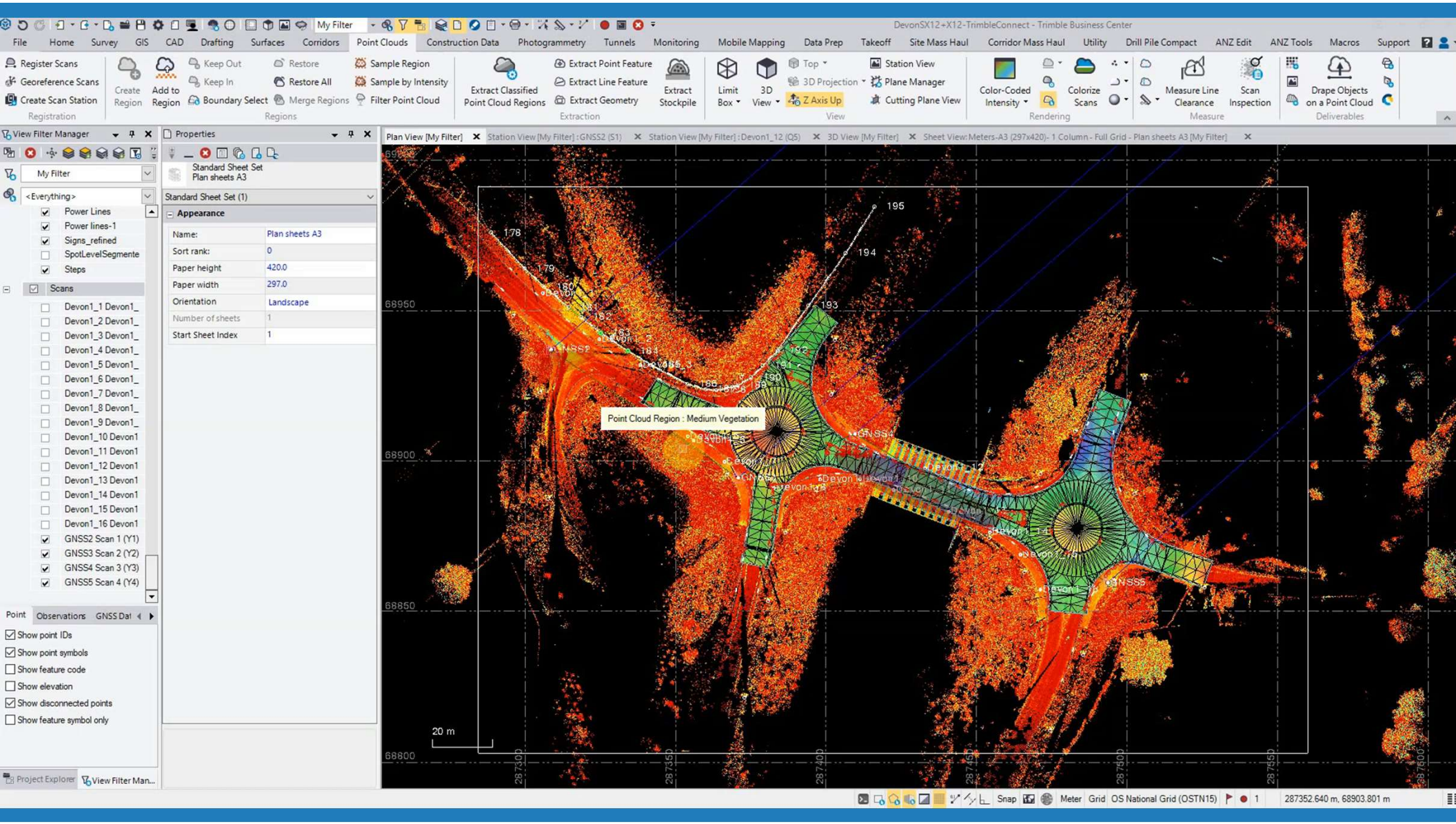
Measure


DevonSX12+X12-TrimbleConnect - Trimble Business Center
File
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Takeoff
Site Mass Haul
Corridor Mass Haul
Utility
Drill Pile Compact
ANZ Edit
ANZ Tools
Macros
Support
Register Scans
Georeference Scans
Create Scan Station
Registration
Create Region
Add to Region
Keep Out
Keep In
Boundary Select
Restore
Restore All
Merge Regions
Regions
Sample Region
Sample by Intensity
Filter Point Cloud
Extract Classified Point Cloud Regions
Extract Point Feature
Extract Line Feature
Extract Geometry
Extract Stockpile
Extraction
Limit Box
3D View
Top
3D Projection
Z Axis Up
Station View
Plane Manager
Cutting Plane View
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Devon1_3 Devon1_
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Devon1_5 Devon1_
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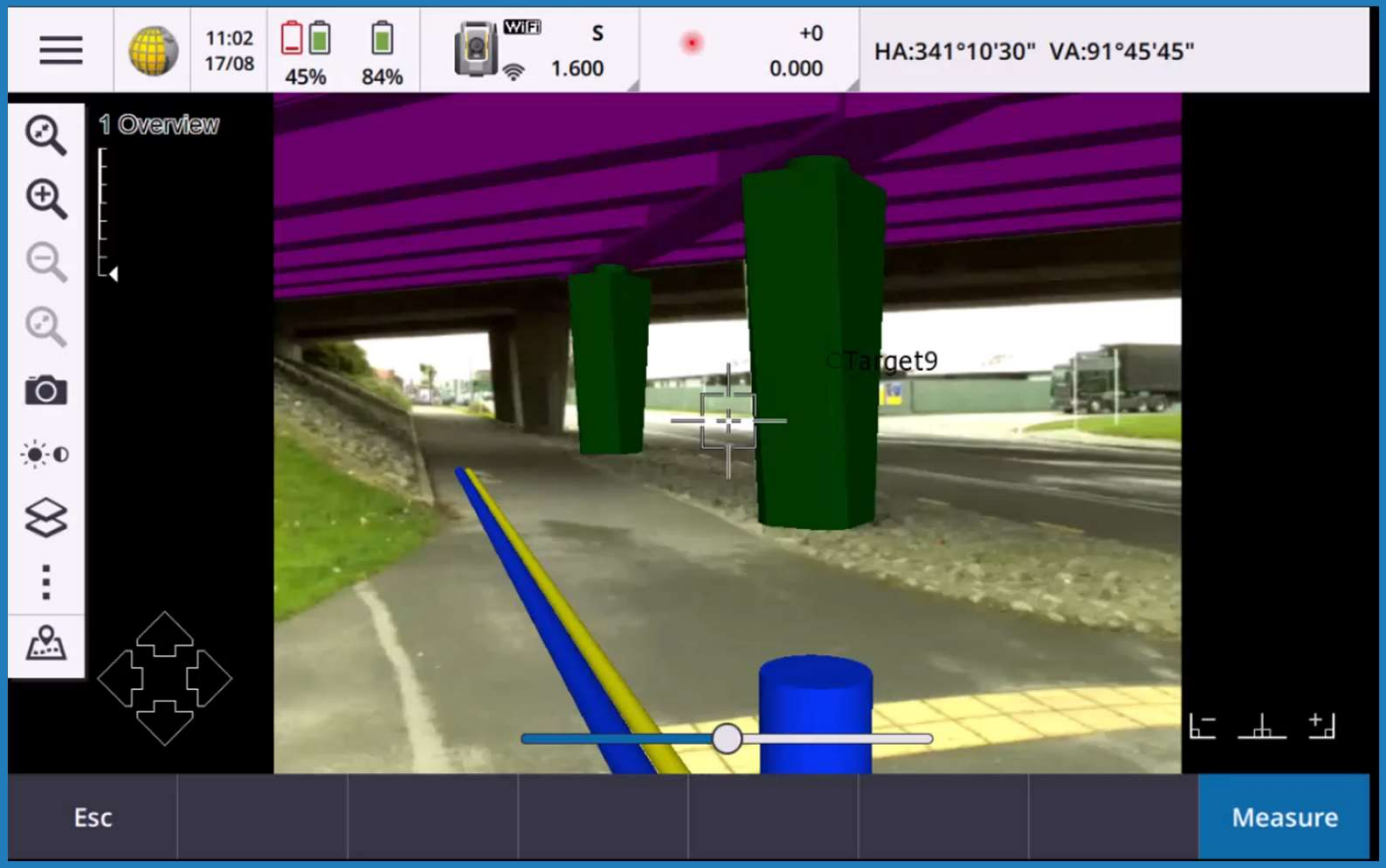
Devon1_15 Devon1
Devon1_16 Devon1
GNSS2 Scan 1 (Y1)
GNSS3 Scan 2 (Y2)
GNSS4 Scan 3 (Y3)
GNSS5 Scan 4 (Y4)
Point
Observations
GNSS Dat
Show point IDs
Show point symbols
Show feature code
Show elevation
Show disconnected points
Show feature symbol only
Project Explorer
View Filter Man...
Properties
Standard Sheet Set
Plan sheets A3
Standard Sheet Set (1)
Appearance
Name: Plan sheets A3
Sort rank: 0
Paper height 420.0
Paper width 297.0
Orientation Landscape
Number of sheets 1
Start Sheet Index 1
Plan View [My Filter]
Station View [My Filter] :GNSS2 (S1)
Station View [My Filter] :Devon1_12 (Q5)
3D View [My Filter]
Sheet View:Meters-A3 (297x420)- 1 Column - Full Grid - Plan sheets A3 [My Filter]
Point Cloud Region : Medium Vegetation
20 m
68950
68900
68850
68800
287300
287350
287400
287450
287500
287550
287600
Snap
Meter
Grid
OS National Grid (OSTN15)
287352.640 m, 68903.801 m

Digital to Physical - Bridge MR



Trimble

Connected Construction:

Data driven Digital Construction

Transforming the construction industry again!

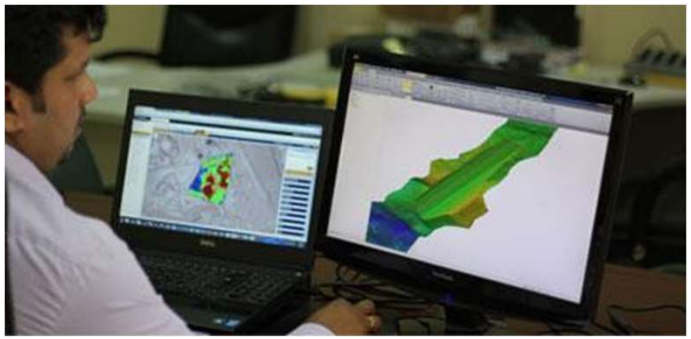
FROM
Conventional Construction

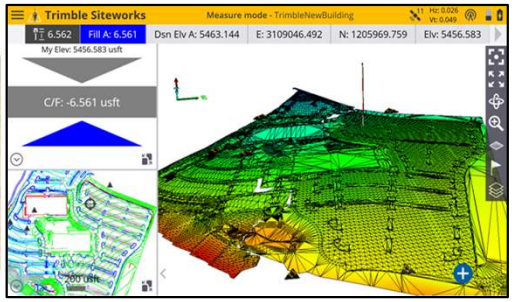
Optimize & Automate Process

- Elimination of Stakes & Strings,
- Eliminate human safety hazards
- Eliminate daylight constraint

TO
Data Driven Digital Construction

SINGLE DIGITAL MODEL FOR ALL





3D Machine Control Technology on Grading Machine

100%+

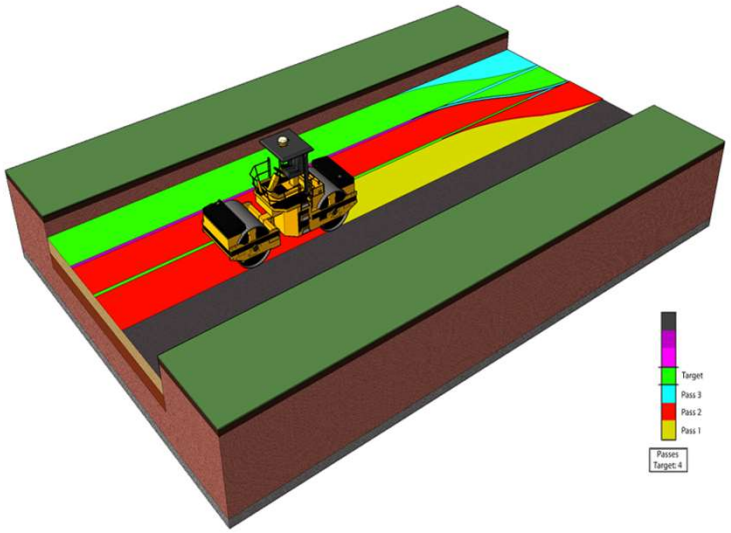
FASTER

- Accurate to Tolerance
- Easy execution of complex design

Night Operation: With high speed and high quality

- Machine Control allows 24x7 operation (day or night)
- With same speed, quality and ease
- No manual guidance required

3D Technology on Compaction and Paving



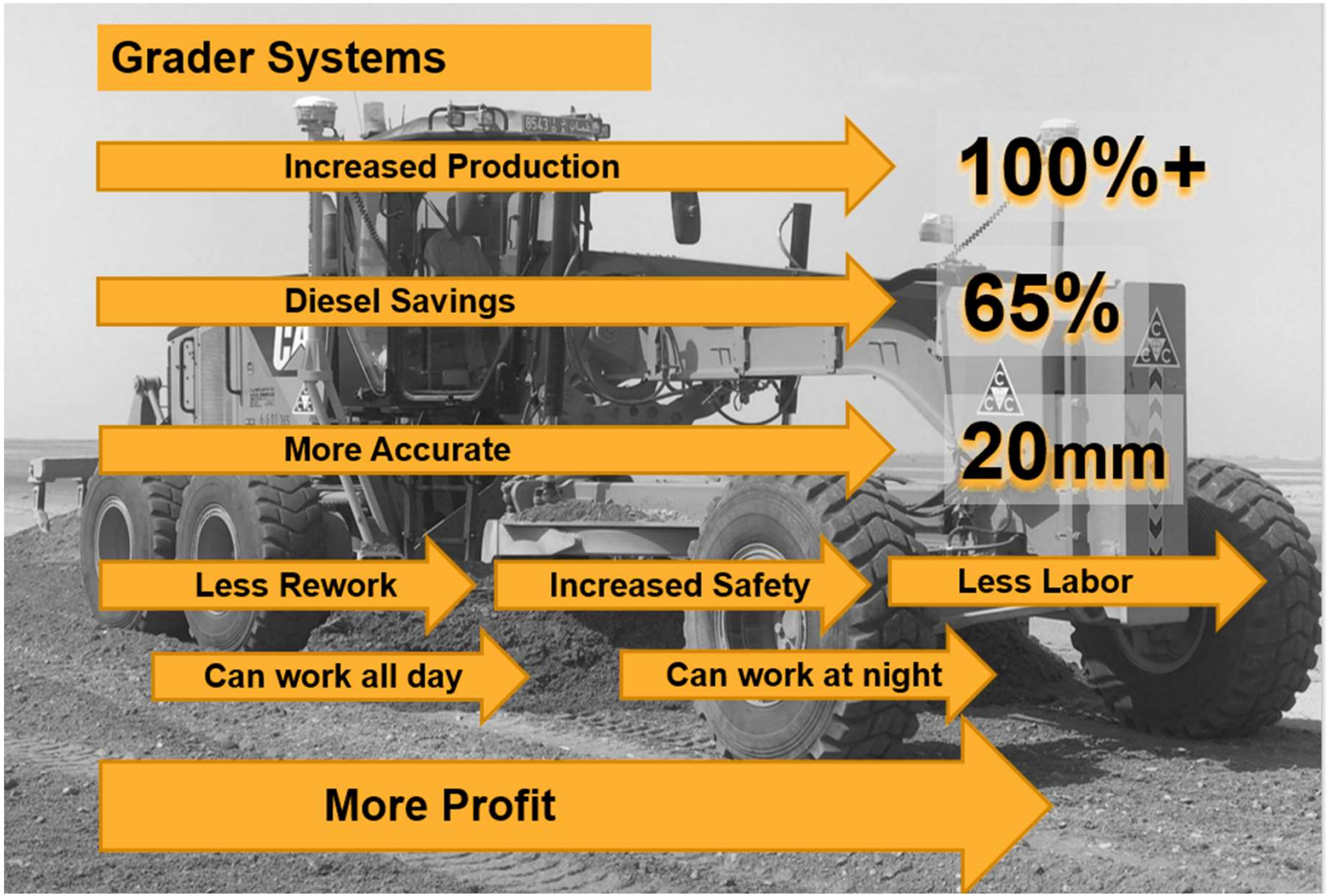
20%
SAVINGS

Assured QUALITY

- Ensures right number of passes
- Avoid over or under compaction
- Realtime Compaction map and measurable records

3D Paving

- Ensures smoothness and rideability
- Eliminate time consuming manual setup and human errors
- Faster paving with better product


Grader Systems
Increased Production
100%+
Diesel Savings
65%
More Accurate
20mm
Less Rework
Increased Safety
Less Labor
Can work all day
Can work at night
More Profit

Productivity Comparison and cost analysis

Cost Components	Conventional Method	Trimble Grade Control Method
Average Productivity Volume / Hour - (in M^3)	107	200
Trimble Grade Control System-Approx. (Cost /hr)		313
Grader-Hire Charges (Cost /hr)	1042	1042
Time in hrs	1	1
Labor Charges (Cost /hr)	625	292
Diesel consumed in liters	14	11
Diesel cost (with rate of INR95/Litre)	1330	1045
Total Cost for Fine grading (Cost /hr)	2997	2691
Total Cost for Fine grading/M^3	₹ 28.01	₹ 13.45

Savings = INR 14.55/ m^3

Percentage of saving in M^3 grading 51.96 %

Saving through Machine control across stages

Earthwork Dozing Compaction Grading Paving

Owner

- Faster and on-time execution
- Reduced Project Cost
- Collaborative Execution of Design
- Higher Quality - smoothness, rideability, compaction
- Digital records for Audit, future planning and expansion

Contractor

- Faster production with high accuracy – Early completion
- Lower Cost of production
- Day/Night all weather operation, higher utilization of machines/assets, higher ROI
- Less rework – First time right
- Less wastage

Trimble Geospatial

GNSS Positioning Services

Trimble RTX

Survey & Mapping GNSS Systems

High Precision Mixed Reality

Mobile & Cloud "Asset First" Software

Ruggedized & Specialized Handhelds, Controllers, & Tablets

High Precision Optical Positioning & Reality Capture

Mobile Mapping

Thank You

For Queries:
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