Improving Construction efficiency using Reality Capture

Niyazi Kemer

Senior Technical Specialist

AUTODESK. UNIVERSITY

About the speaker

Niyazi Kemer

Niyazi has worked extensively on Autodesk Revit Architecture and has been involved with implementing BIM in two of the biggest projects in Turkey in which he served as the chief of architectural design. He also has 3 years of teaching experience with Revit and is currently operating as an AEC Technical Expert in Turkey.

REALITY CAPTURE

Definition

Reality Capture is the process of producing a digital 3D model representation of your object, building or site created by scanning it in the real world using static, mobile and aerial laser scanning and/or photogrammetry.

With either laser scanning or photogrammetry methods, millions of surface points are measured and mapped to develop a textured, high-resolution, geometrically precise 3D model.

Current Practices

The current practice for capturing existing field conditions is a tedious, manual, often analog and inaccurate process, which leads to costly rework. Whether a building renovation or large-scale infrastructure project, the surveying and documentation process looks something like this:

Current Practices

- Start with a static raster image of a very old blueprint and trace it into a CAD format so that it becomes editable.
- Visit the site to verify that existing conditions on the ground match the blueprint. Measuring with a distance meter or tape measure, capture any changes or inconsistencies with the existing plans.
- Find a way to capture complex, hard-to-measure objects and details like exposed piping, that cannot be accurately captured in a simple, efficient way.

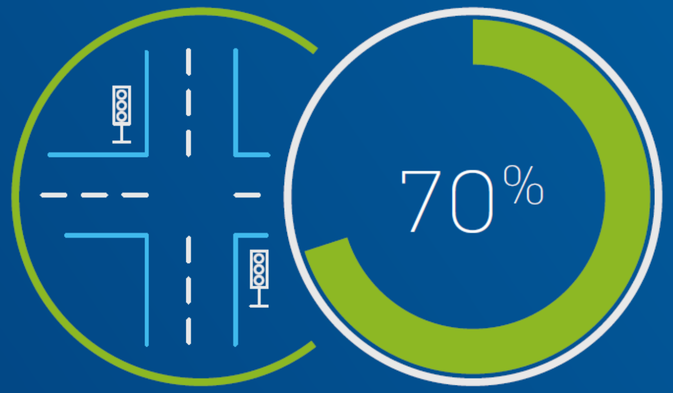
Accuracy Limitations

- Limitations in accuracy and coverage of data points from traditional surveying methods
- Older CAD drawings or 3D models, which are often inaccurate, inadequate sources of as-built data.
- Inconsistent survey data which requires additional surveys over the course of the project.

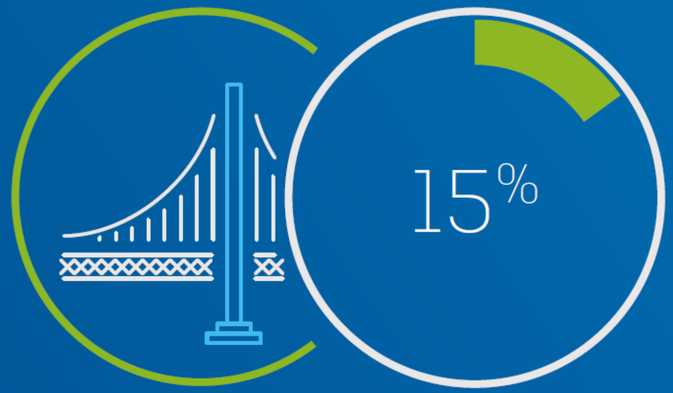
Costly Services

- Cost of professional survey specialists.
- Unforeseen cost add-ons from multiple return trips due to missed or inconsistent measurements.
- Cost overruns from rework due to insufficient capture of complex existing conditions.

80% of non-residential buildings are more than 20 years old



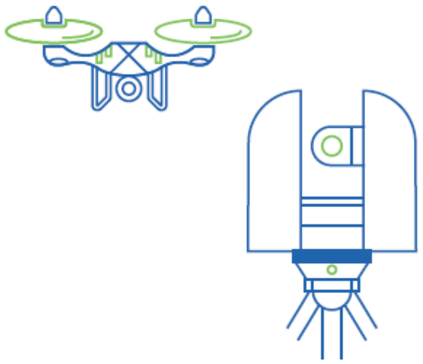
In the UK, 70% of the infrastructure in projects are over 100 years old



15% of Germany's municipal road bridges need to be completely rebuilt

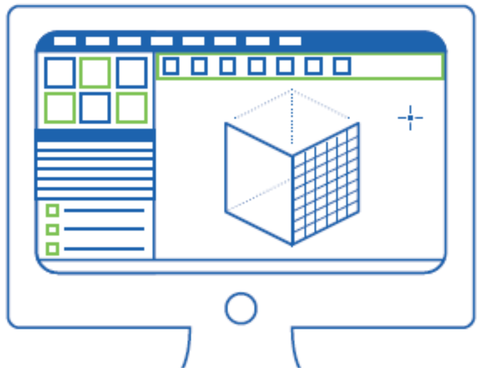
How Big is the Problem Really?

- An increasing amount of non-residential buildings and infrastructure currently or will soon need major repair.
- In the UK, 70% of transportation of transportation infrastructure is over 100 years old
- Bim for renovation



1. Capture

2. Compute



3. Create

An Introduction to Reality Capture

There is a better way to capture existing site conditions accurately and completely, in both building renovation and infrastructure projects. Implementing a digital Reality Capture process enables you to minimize labor requirements, save time, and reduce project risk. The result is a highly-accurate, full-coverage, actionable set of real-time data, which can be directly connected into 2D and 3D design processes.

When to Capture?

PRE CONSTRUCTION

Expansion, Renovation, Restoration, Existing conditions / Cut and Fill analysis / Design Coordination Contour mapping

C O N S T R U C T I O N

Collaboration / Visualization / Health and Safety / Quality / Edge of slab, openings , Levelness, Progress tracking / Above Ceiling Conditions

P O S T

As built / In wall and in slab works / Facilies management

Benefits

Accuracy is Everything

You can measure the model, view and analyze data in elevation maps, organize and clean up regions within the point cloud, create a mesh, and manipulate the model.

Benefits

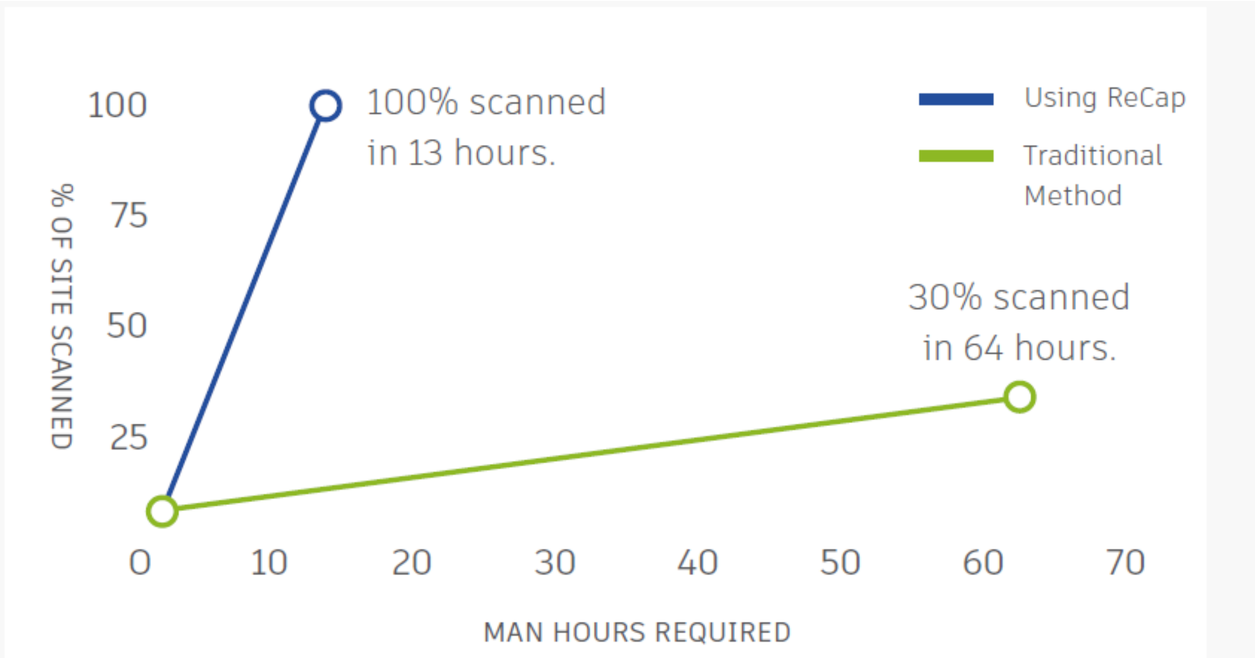
Built-in Efficiencies

The simplicity of the scanning process also **significantly reduces the labor costs spent on surveying and documentation**. You can capture billions of points as opposed to tens or hundreds from traditional processes. This galvanizes your ability to access and manipulate as-built data, making workflow transitions into design authoring and simulation more seamless.

BENEFITS

Less Manual Work and Trips to the Jobsite

Instead of time wasted on return trips and repeatedly scanning a site, you can deliver full site scans in intelligent, digitized formats in a matter of days instead of weeks, and move onto the next project.

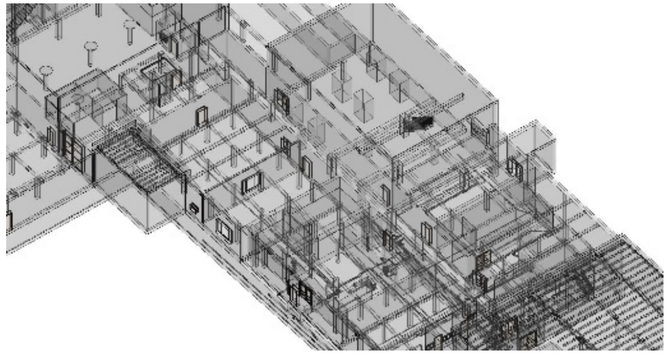


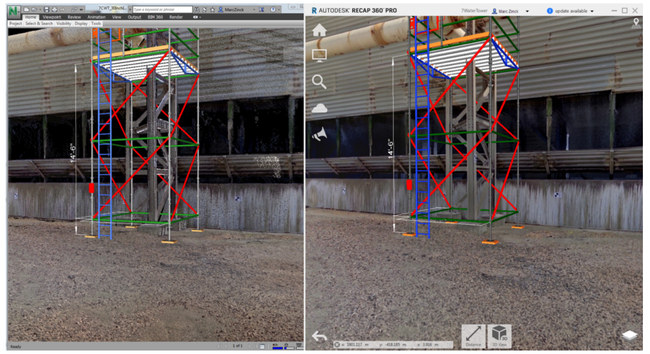
BENEFITS

Collaboration

Through implementation of software tools, Reality Capture becomes a collaborative process, not just a simple documentation process.

When the reality data is uploaded to the cloud, it becomes **ready to manipulate in real time, enabling immediate stakeholder interaction, which in turn hastens decision-making.**

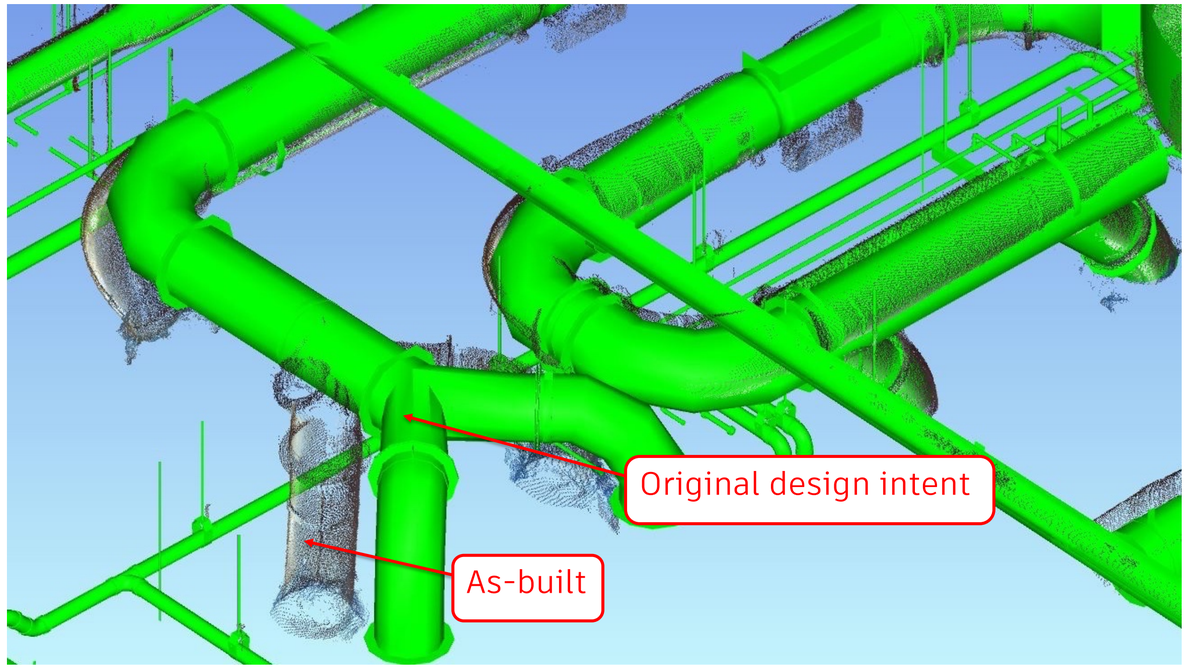




BENEFITS

It Validates the Construction Process

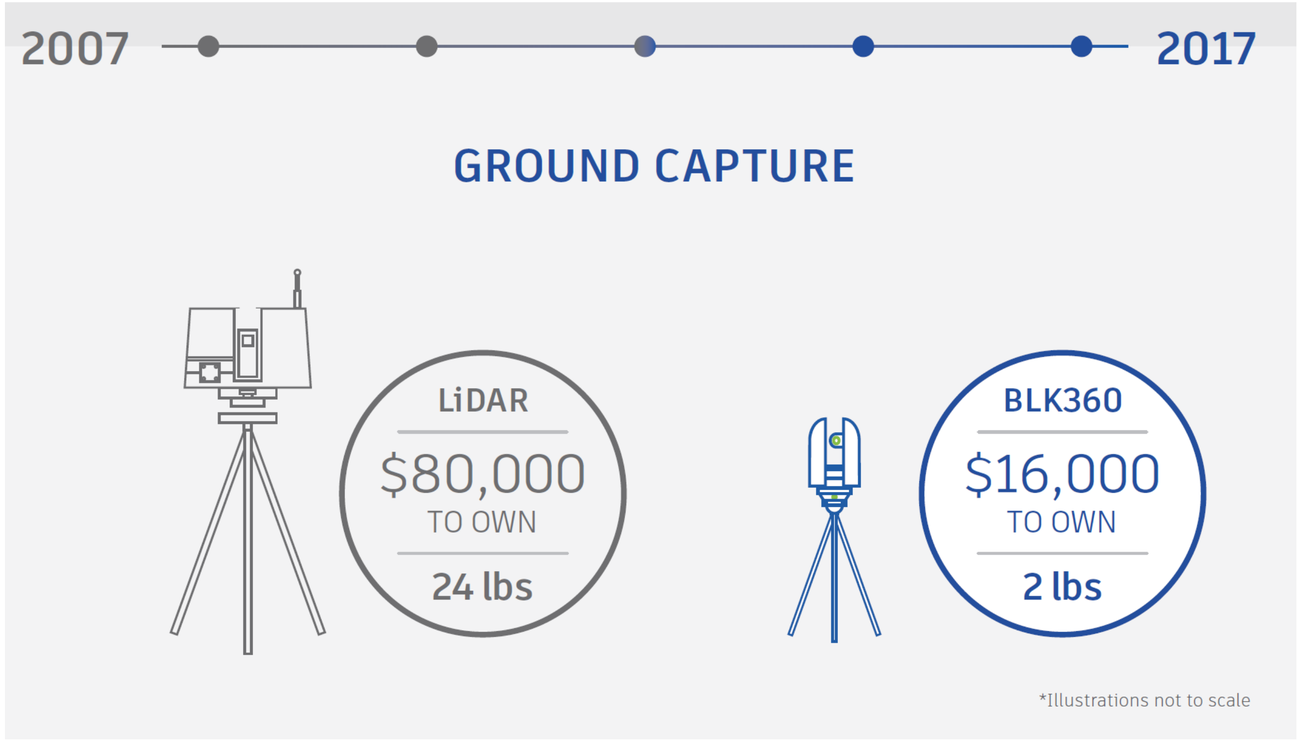
The scanning process makes it easy to take continual scans for comparison purposes and visual logs, which in turn can act as regular progress updates for the team



HOW TO CAPTURE

LiDAR

LiDAR, also sometimes called laser scanning, works by shooting pulses of laser light at an object and then measuring the distance based on how long it takes the light to return to the sensor. Like photogrammetry, LiDAR can be used from the ground or the air, but it has become a more accessible and practical scanning technique now that drones are common.



HOW TO CAPTURE

Photogrammetry

Photogrammetry is a form of 3D scanning that uses photographs and triangulation to create an accurate model of a site or structure. Photogrammetry scanning can be performed at close range, via satellite, or from the air.

3DR

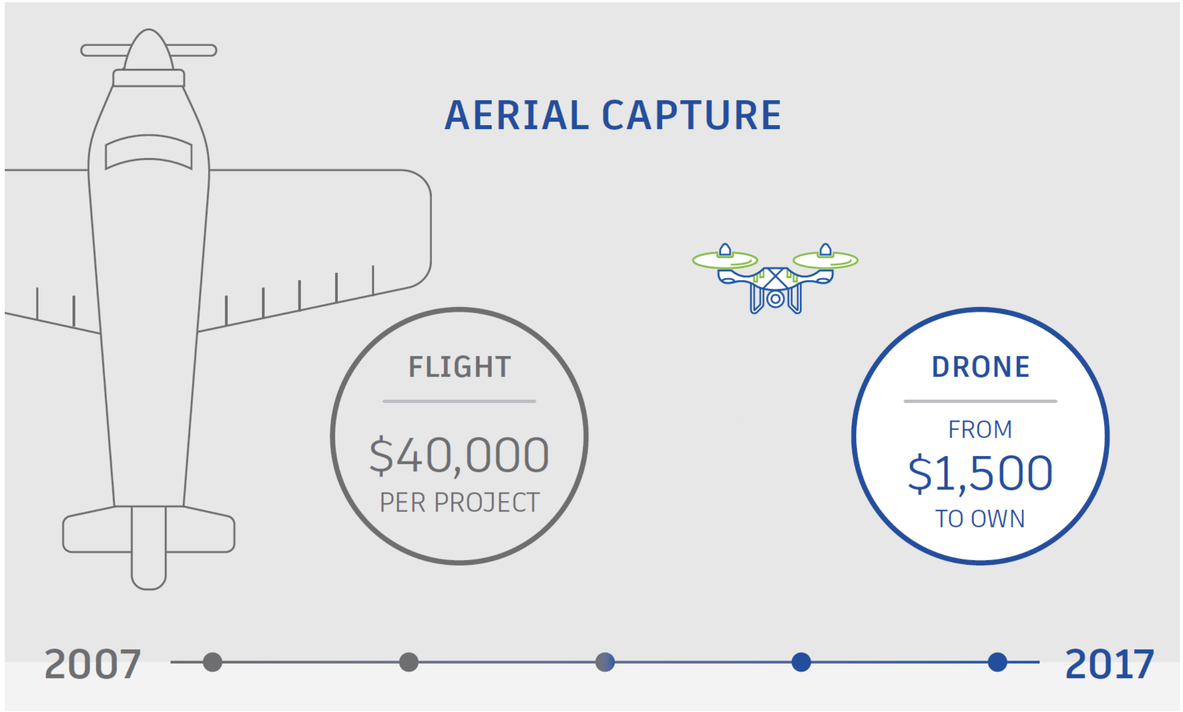
matterport

Pro2 3D Camera

HOW TO CAPTURE

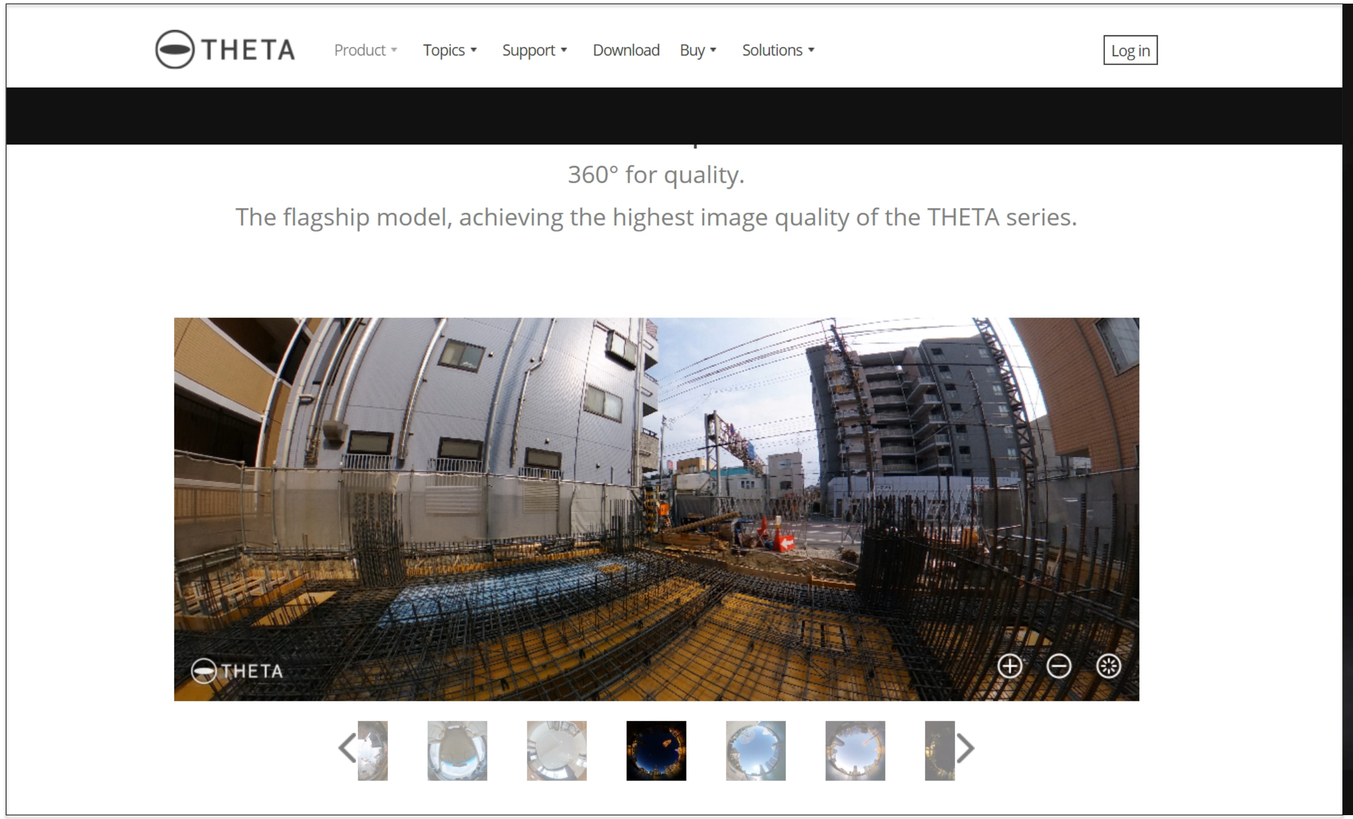
Unmanned Aerial Vehicles (UAVs aka Drones)

- Drones have become inexpensive to own and operate
- The FTA created clear and practical rules for legal commercial use
- They make it fast, easy, and cheap to gather critical site and structure data



HOW TO CAPTURE

360 Photos



HOW TO CAPTURE

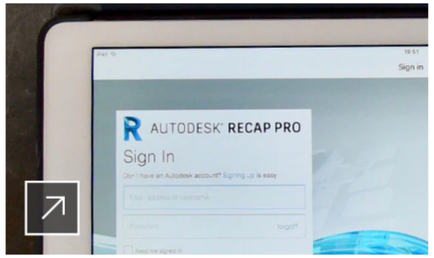
Others

RECAP

RECAP

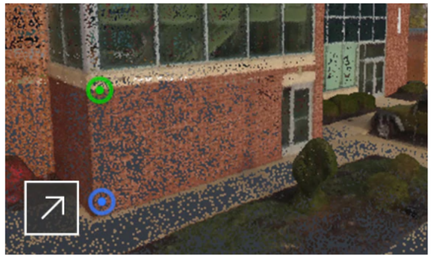
Autodesk ReCap is a 3D program for complex laser scanning and photogrammetry projects. It exports files into a proprietary format, which can seamlessly integrate into other Autodesk software applications. Use ReCap Reality Capture software to convert reality into a 3D model or 2D drawing that’s ready for further design.

ReCap Photo



ReCap Pro for mobile

Automatically register laser scans



Measure and edit point clouds

Integrate Navisworks data

RECAP PRO

RECAP PRO

Capture

Photo and Laser

Compute

Automatic scan registration
Intelligent cleanup service

Create

Workflow integration

RECAP PRO


AUTODESK RECAP 360 PRO
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AUTODESK RECAP 360 PRO
+5
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AUTODESK RECAP 360 PRO
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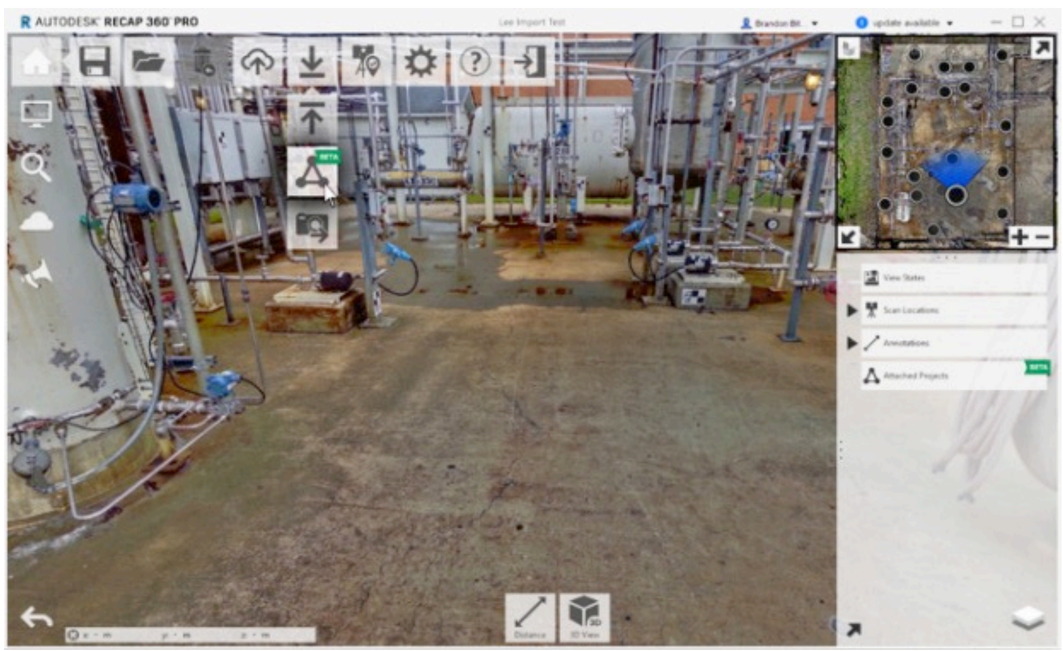
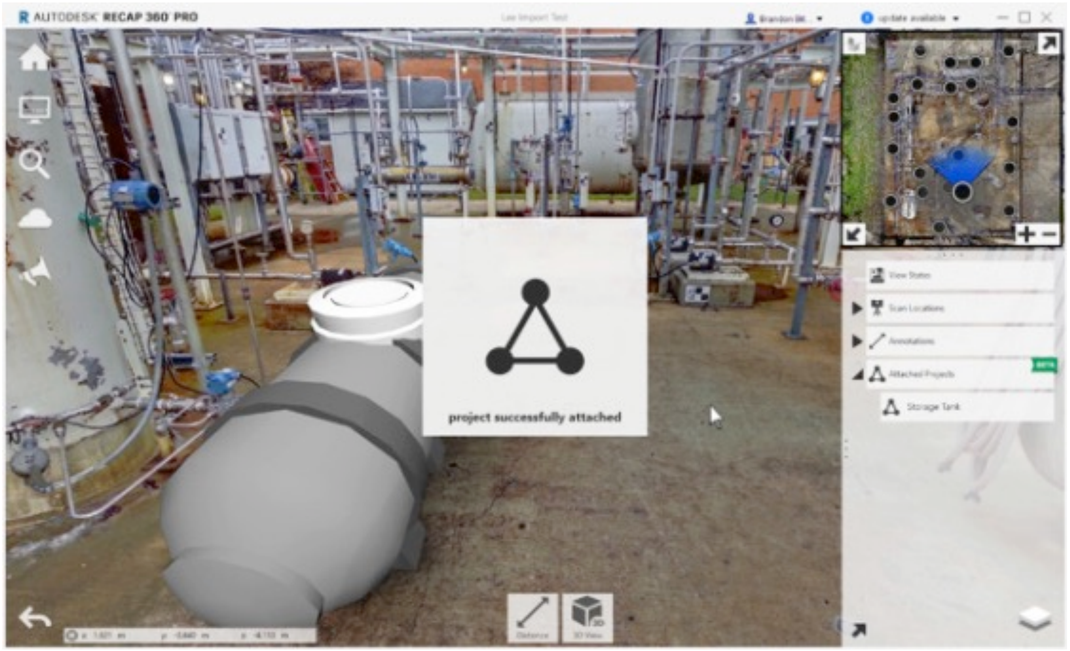
RECAP PRO


AUTODESK RECAP 360 PRO
View States
Scan Locations
Annotations
Attached Projects
BETA


AUTODESK RECAP 360 PRO
project successfully attached
View States
Scan Locations
Annotations
Attached Projects
Storage Tank
BETA

ReCap Pro app for iPad Pro®

RECAP

Reality Solutions SDK

Last year announced the launch of our Reality Solutions SDK, which made our point cloud format available to partners so they can develop innovative solutions for our customers

HOLO BUILDER

POINTFUSE®

As-Built™ for Autodesk® Revit®

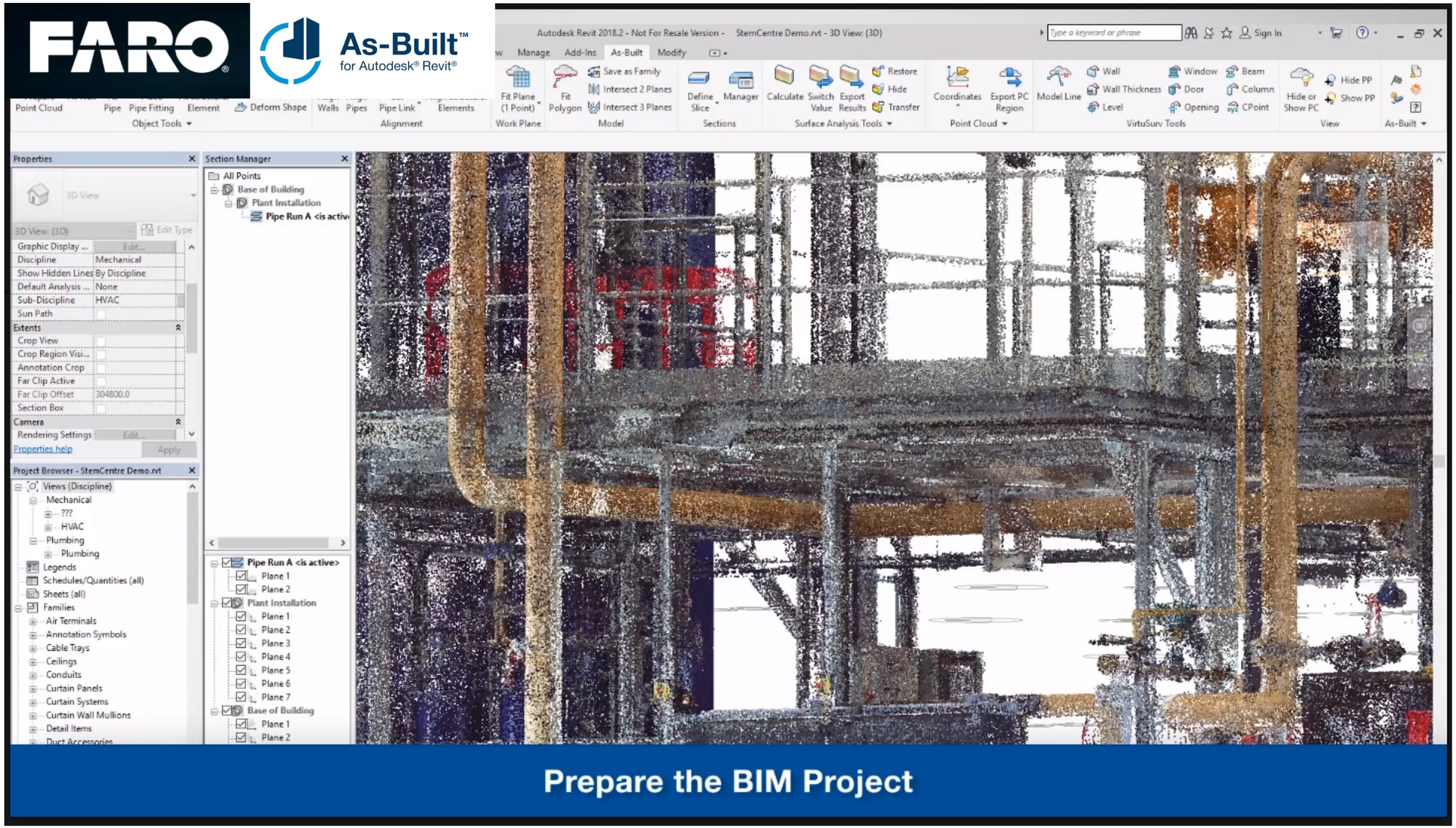
Pointerra

RECAP

Reality Solutions SDK

FARO

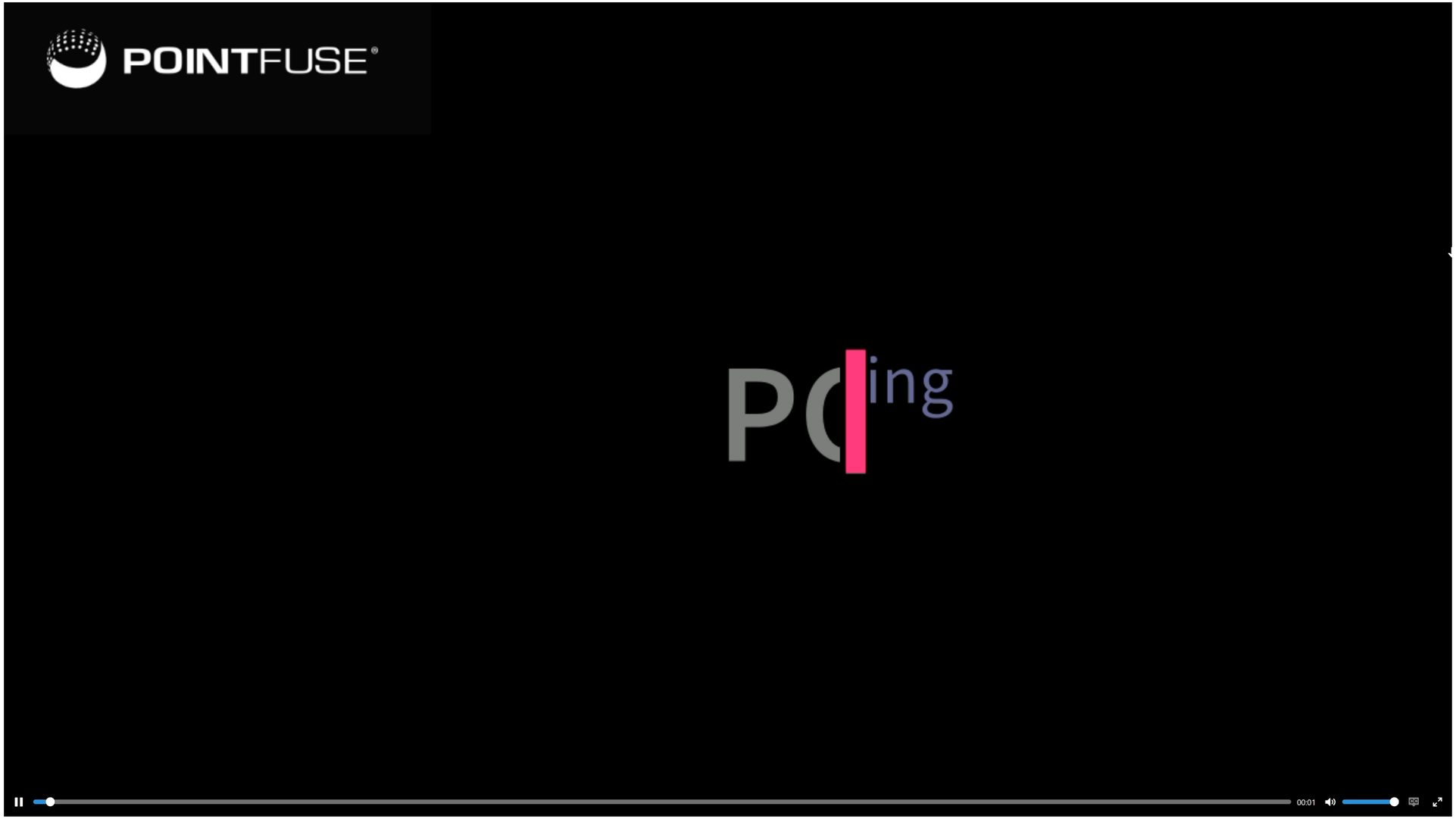
As-Built™ for Autodesk® Revit®



Prepare the BIM Project

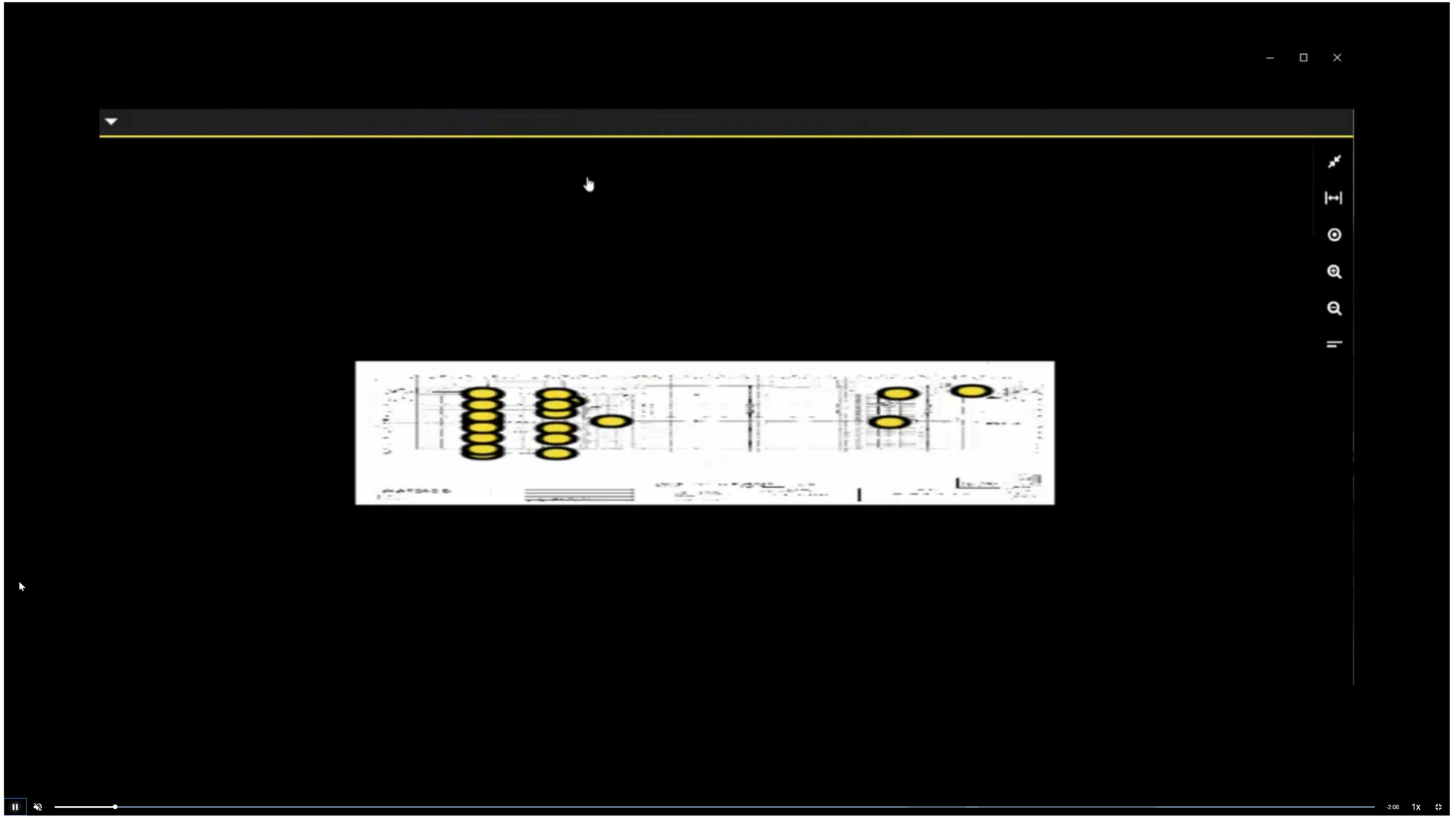
RECAP

Reality Solutions SDK



RECAP

Reality Solutions SDK



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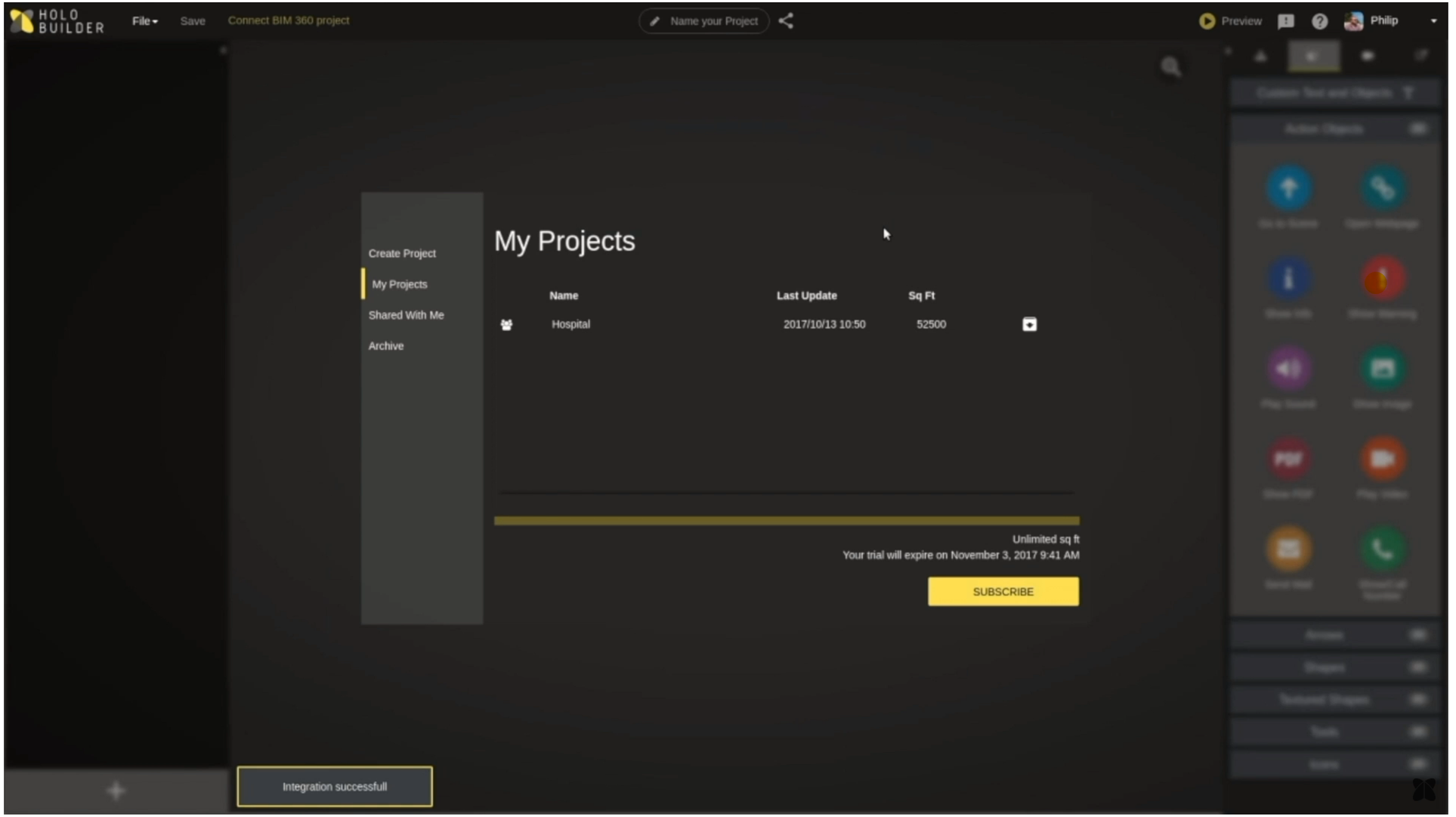

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As built / In wall and in slab works / Facilies management

Technologies

CCS232382 REALITY CAPTURE AND BIM 360: FEATURING 3DR,HOLOBUILDER AND SMARTVID.IO

This class will consist of three 30 min presentations from BIM 360 Integration Partners.

3DR: Tying it all together: Using BIM360 to bring cutting-edge tech into existing workflows

Holobuilder: Evolution of Reality Capture: Where we are and where we are going. No matter

where you are on the spectrum, it's time to jump on the wagon!

Smartvid.io : Reducing safety risk at Suffolk, Skanska, Clayco with Autodesk's BIM 360 and

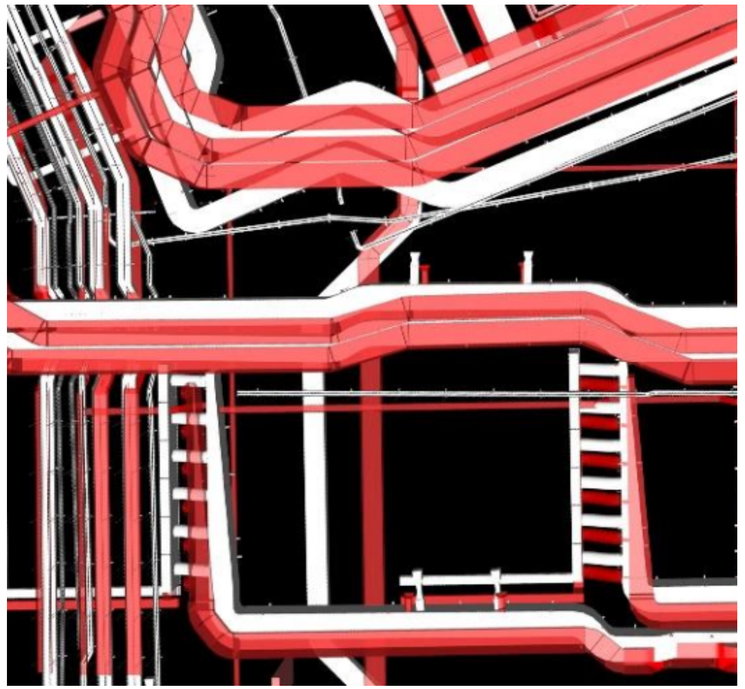
artificial intelligence

https://www.autodesk.com/autodesk-university/class/Reality-Capture-and-BIM-360-Featuring-3DR-Holobuilder-and-Smartvidio-2018

Post Construction

SBG / BLD122339 IS 3D SCANNING A REAL AS-BUILT

In this class, megaconstruction firm Saudi Binladin Group (SBG) will share 2 years of challenges faced using innovative technology to cut through one of the longest and most complicated processes in construction projects. We will discuss real-time benefits to project time and accuracy of as-built development in this $1 billion project. From this experience of using reality capture technology and Autodesk applications and how they relate to 3D scan technology, SBG has developed a successful methodology of project handover and as-built by reconstructing an intelligent model out of 3D reality-capture point clouds. In this class, SBG will show workflow from points capture to as-built record Models and Sheets. SBG will also provide the pros and cons of each step. Over a 2-years journey, SBG used different Autodesk software such as Revit software and ReCap software, and also different third-party tools and service providers.



https://www.autodesk.com/autodesk-university/class/3D-Scanning-Real-Built-2017

Post Construction

SBG / BLD122339 IS 3D SCANNING A REAL AS-BUILT

3D Scan ROI

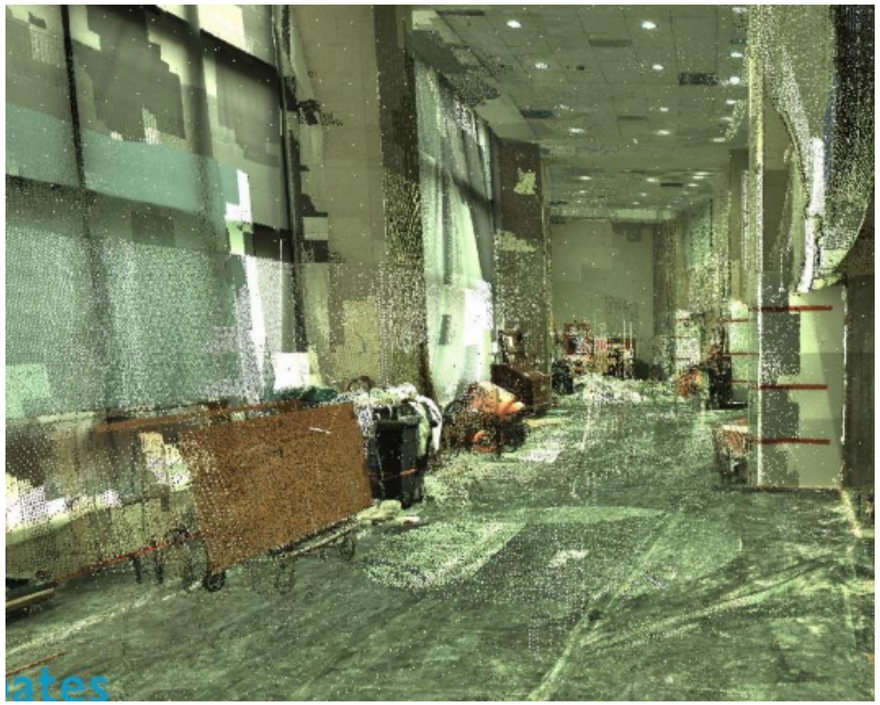
- SBG invest in this innovative technology and take the advantage of:
  - Reduce Data Acquisition time to 10% of planed schedule.
  - Eliminate major process obstacle (Consultant to verify and approved Exiting Condition drawing) by his survey team, it was time killer.
  - Site execution is vary from zone to zone and record each activities without hold execution for Consultant verification.
    - Over all processes reduced with 25%, and expect more with learning curve improved.

https://www.autodesk.com/autodesk-university/class/3D-Scanning-Real-Built-2017

Pre C. / Construction and Post Construction

BATES/ REALITY CAPTURE: BENEFITS, WORKFLOWS, AND HOW TO GET STARTED!

This class will demonstrate various reality capture strategies and use cases in different architecture, engineering, and construction project phases. We'll focus both on strategies that can be implemented in-house as well as options for integrating outsourced deliverables into in-house workflows. We have integrated point clouds from laser scans and unmanned autonomous systems (UAS) photogrammetry, and we'll show our workflows and results. We'll talk about the setup process for attaining accurate shared coordinates for automated GPS placement within Revit software. We'll also demonstrate how we created and implemented affordable UAS photogrammetric scans into our Revit workflows, and how they compare to laser scan point clouds. This class will showcase several case study projects in which we used laser and photogrammetric scans for various needs, ranging from developing design concepts for small residential additions to new large-scale health care projects and multimillion-dollar departmental relocations inside existing facilities.

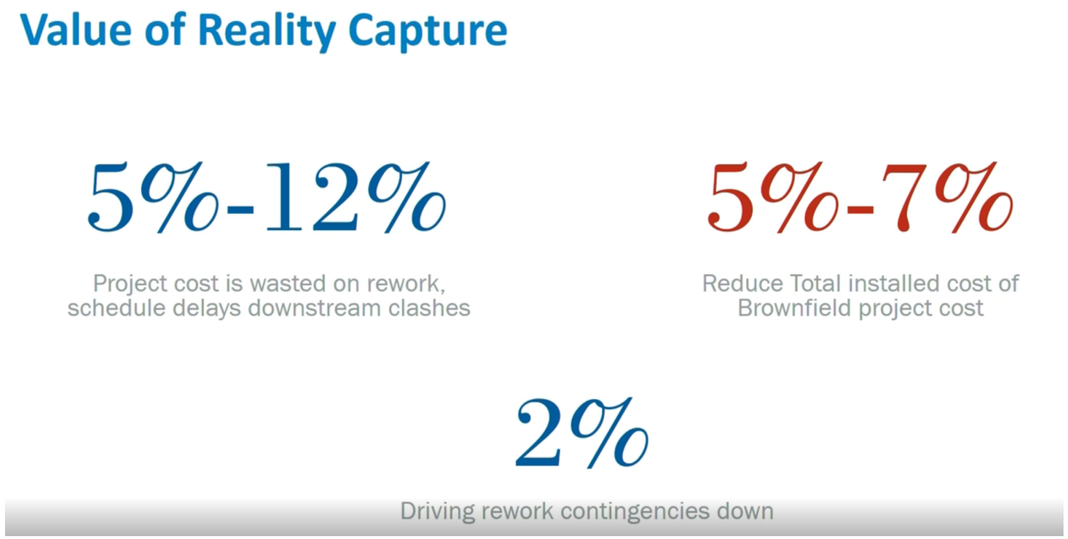


https://www.autodesk.com/autodesk-university/class/Reality-Capture-Benefits-Workflows-and-How-Get-Started-2017

Pre C. / Construction and Post Construction

DPR / EXTRACTING CONSUMABLE CONSTRUCTION INTELLIGENCE FROM REALITY CAPTURE DATA

Reality capture is a process of capturing as-is conditions as images or point clouds using various means, including laser scanners, LIDAR (light detection and ranging) sensors, 360º cameras, unmanned aerial vehicles (UAVs), and more. All of these different modes spit out different output files that can then be converted to usable point cloud or vector data. Extracting construction intelligence from the point cloud or vector data and sharing it in a consumable format is the key for the success of any reality capture process. This class will detail laser scanning and UAV data-capture and intelligence-extraction workflows for different use cases, such as quality control/quality assurance, construction planning, site logistics, data-rich 3D modeling, intelligent as-builting, construction progress reporting, and so on.

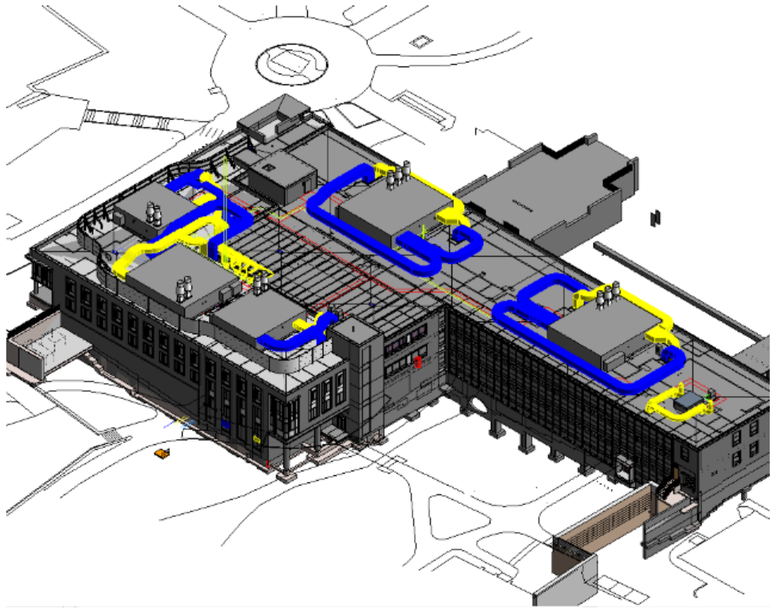


https://www.autodesk.com/autodesk-university/class/Extracting-Consumable-Construction-Intelligence-Reality-Capture-Data-2017

Construction and Post Construction

SKANSKA / LASER SCANNING DURING CONSTRUCTION: FIVE CASE STUDIES DEMONSTRATING PRACTICAL USE

Laser scanning is nothing new. The tools have been around for years now, but the spread of incomplete knowledge about the technology has created a stigma that devalues its true capabilities. As with any piece of technology, the value is limited by the implementation and workflow more than the tool itself. This class will provide five examples of uses demonstrated on projects this past year. The focus will be on practicality-where time and labor are often short on construction sites-and simplicity. Whether we want to determine the plumbness of a wall, or the flatness of a slab, or we want to back check as-builts of brick ledges, tie utilities into an existing building, or create a template of a repetitive room for quick modeling and coordination purposes, this class will explore what it takes and what we got from it-unfiltered.

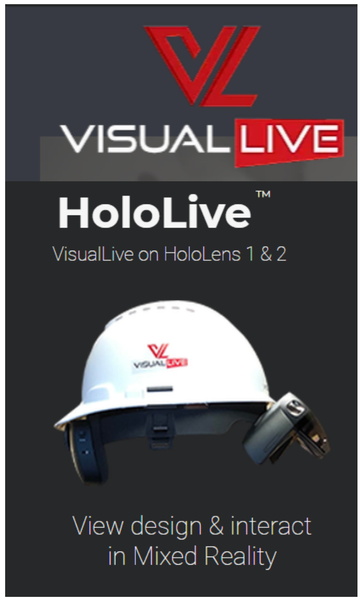


https://www.autodesk.com/autodesk-university/class/Laser-Scanning-During-Construction-Five-Case-Studies-Demonstrating-Practical-Use-2019

Post Construction / FM

VISUALLIVE/ AUGMENTED REALITY: SPEEDING UP FIELD VERIFICATION AND COMMUNICATION

Often when systems are installed or after systems are laser scanned, we discover issues that lead to rework. Augmented reality (AR) has been a buzzword in construction for quite some time, and it’s a technology that can improve the installation verification process—but it’s still not widely used. In this session, we’ll identify the advantages of using AR during the design phase and the construction phase, and for facilities management. This class will also identify the different ways to improve communication workflow through AR.



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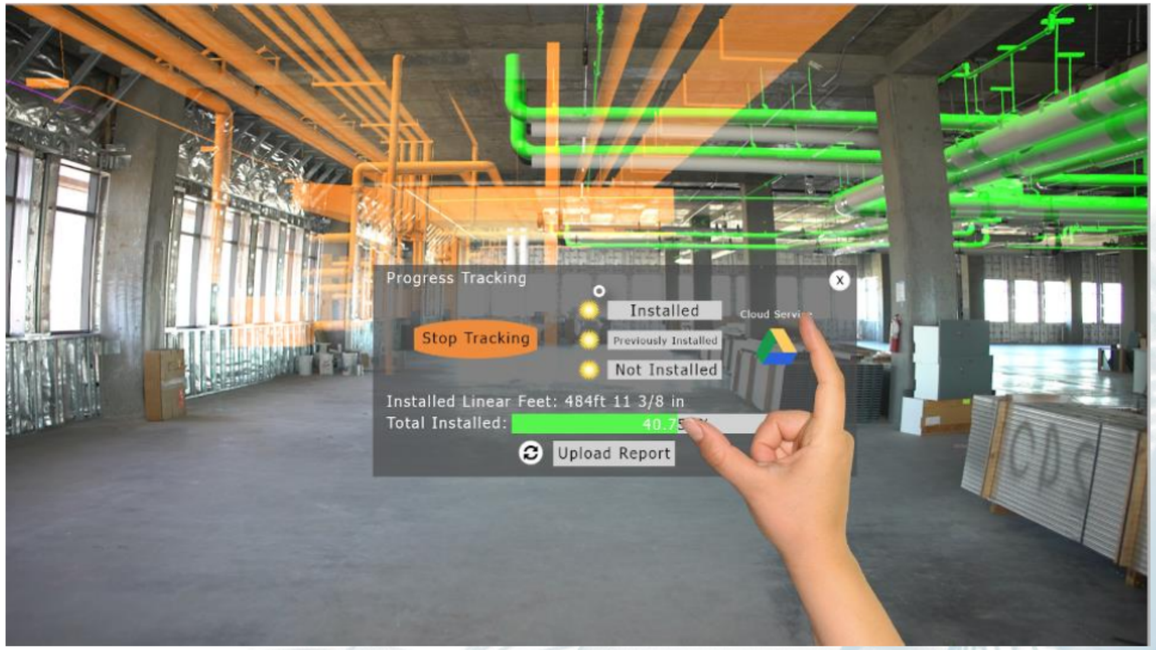
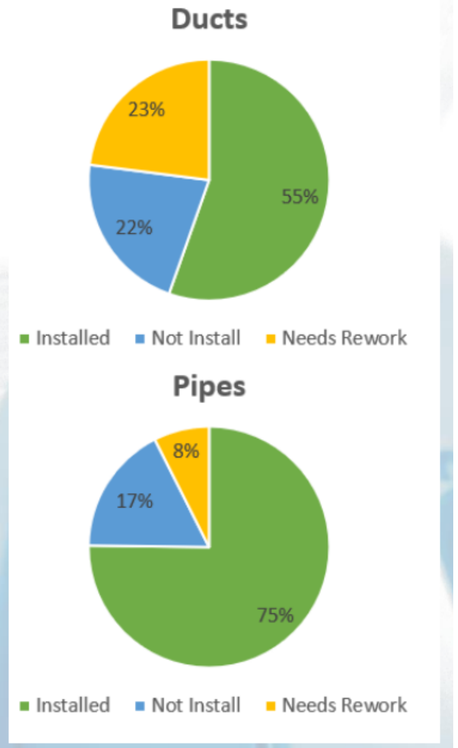
Post Construction / FM

AUGMENTED REALITY: SPEEDING UP FIELD VERIFICATION AND COMMUNICATION

Install Validation – Install Progress Tracking





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