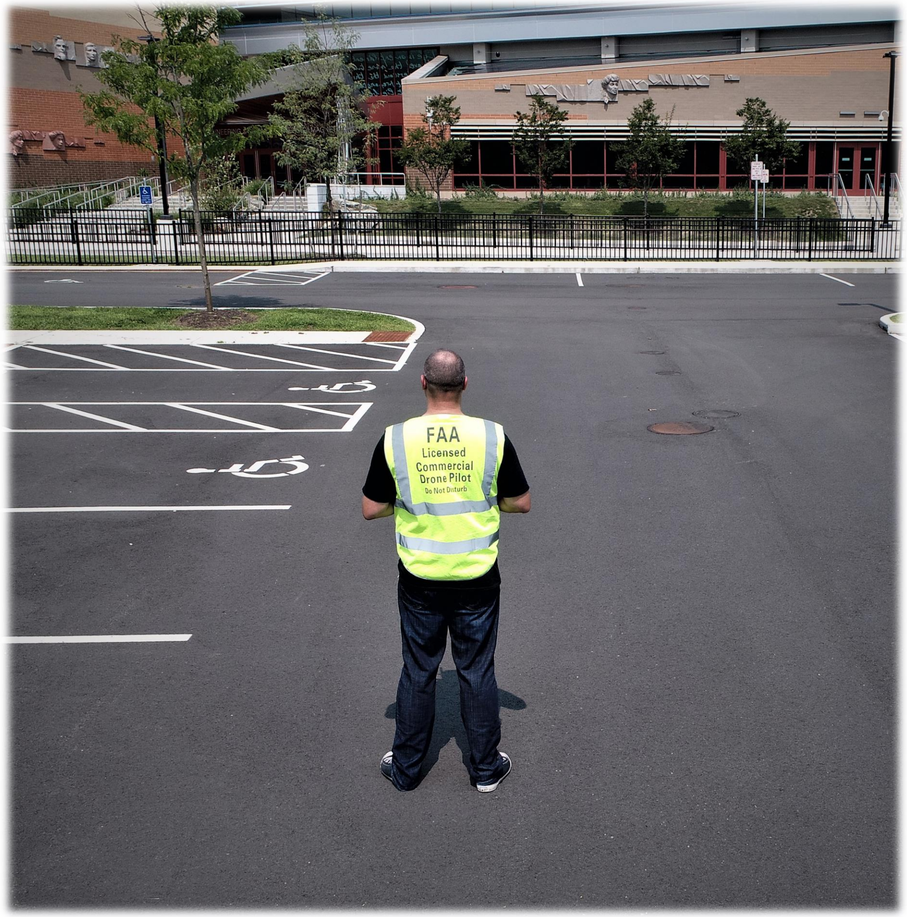
Drones, Photogrammetry and the AEC Collection

Matt Wunch

sUAS Pilot/Owner @ SkyViz.io

AUTODESK. UNIVERSITY



About the speaker

Matt Wunch

- Owner of SkyViz.io
- FAA Part 107 certified pilot (2+ years)
- AUTODESK® **EXPERT ELITE**
- 25 years in the AEC industry
- AUGI Board of Directors

https://twitter.com/mattwunch

https://www.linkedin.com/in/mattwunch/

Learning Objectives

OBJECTIVE 1

Learn best practices for capturing existing conditions using drones

OBJECTIVE 2

Learn how to process aerial photographs to create accurate, measurable models

OBJECTIVE 3

Learn about the various deliverables

OBJECTIVE 4

Learn how to use the output in Revit, InfraWorks, Civil 3D, Navisworks, and BIM 360

Capturing Existing Conditions

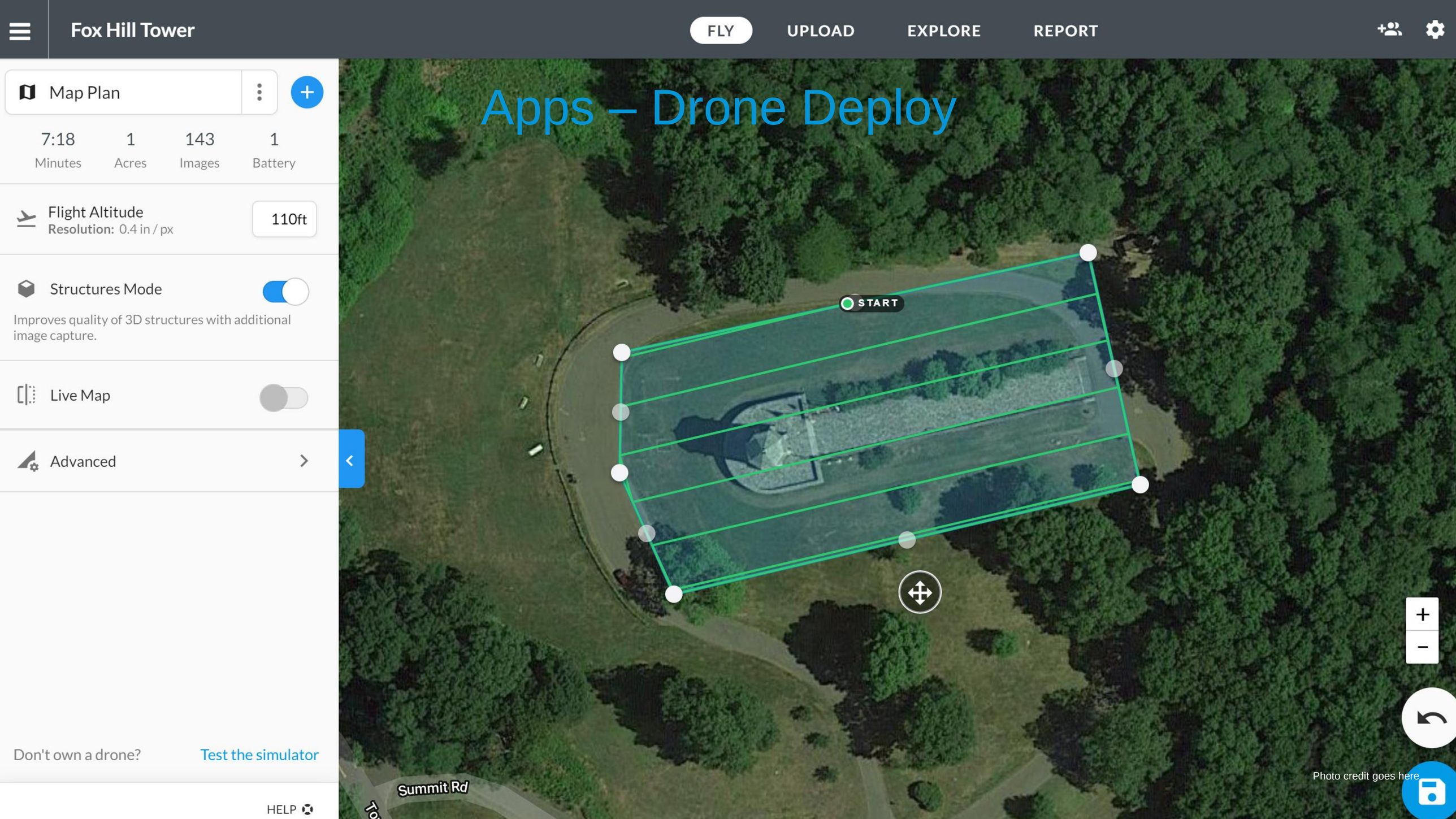
Capturing Existing Conditions – Apps

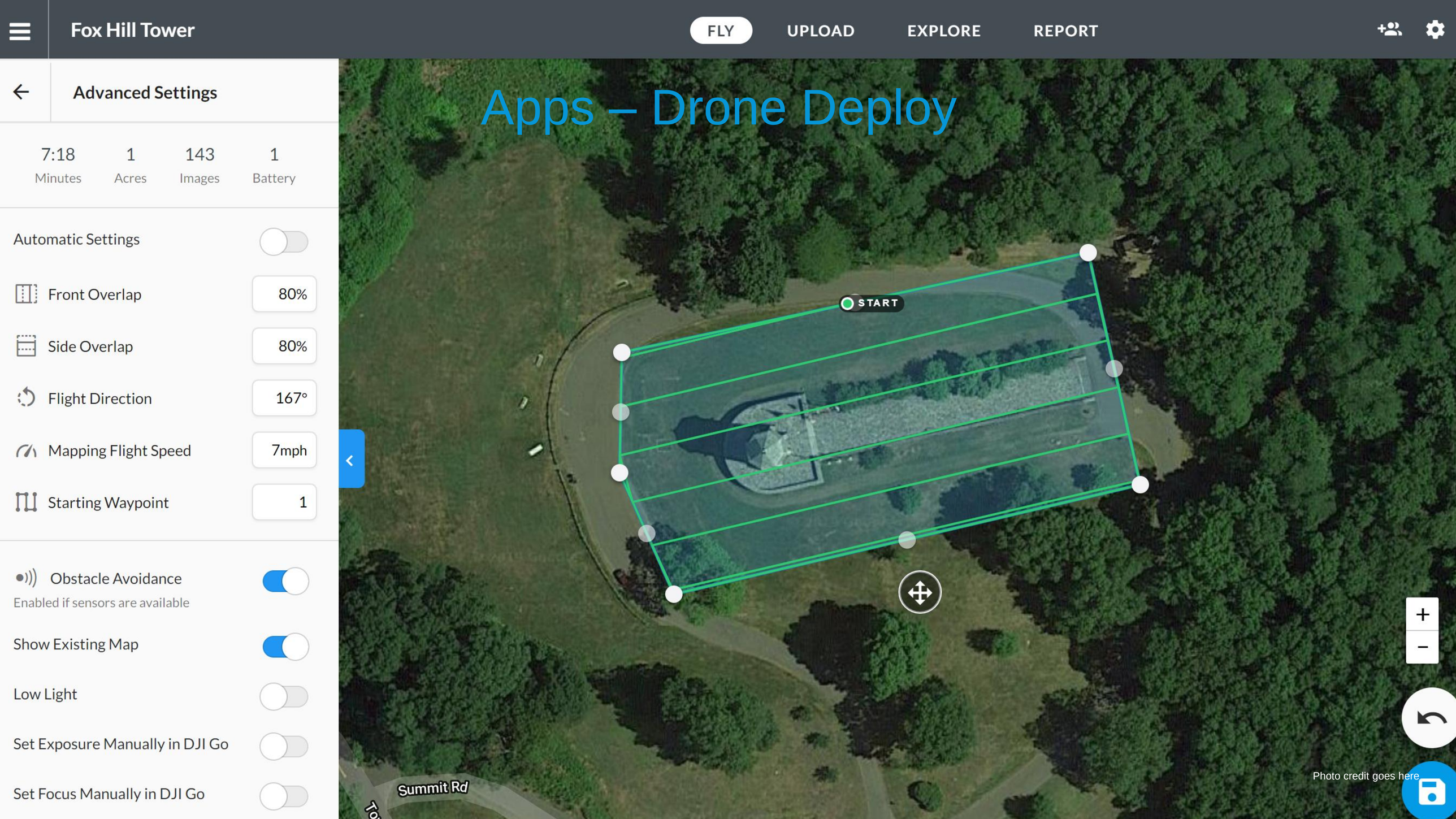
Mission Planning

Single grid vs. Double grid

Autonomous flight apps

Autonomous flight vs manual flight vs autonomous + manual flights


Fox Hill Tower
FLY
UPLOAD
EXPLORE
REPORT
Apps – Drone Deploy
Map Plan
7:18
Minutes
1
Acres
143
Images
1
Battery
Flight Altitude
Resolution: 0.4 in / px
110ft
Structures Mode
Improves quality of 3D structures with additional image capture.
Live Map
Advanced
START
Don't own a drone?
Test the simulator
HELP
Summit Rd
Photo credit goes here


Fox Hill Tower
FLY
UPLOAD
EXPLORE
REPORT
Advanced Settings
7:18
Minutes
1
Acres
143
Images
1
Battery
Automatic Settings
Front Overlap
80%
Side Overlap
80%
Flight Direction
167°
Mapping Flight Speed
7mph
Starting Waypoint
1
Obstacle Avoidance
Enabled if sensors are available
Show Existing Map
Low Light
Set Exposure Manually in DJI Go
Set Focus Manually in DJI Go
Apps – Drone Deploy
START
Summit Rd
Photo credit goes here

Pix4Dcapture

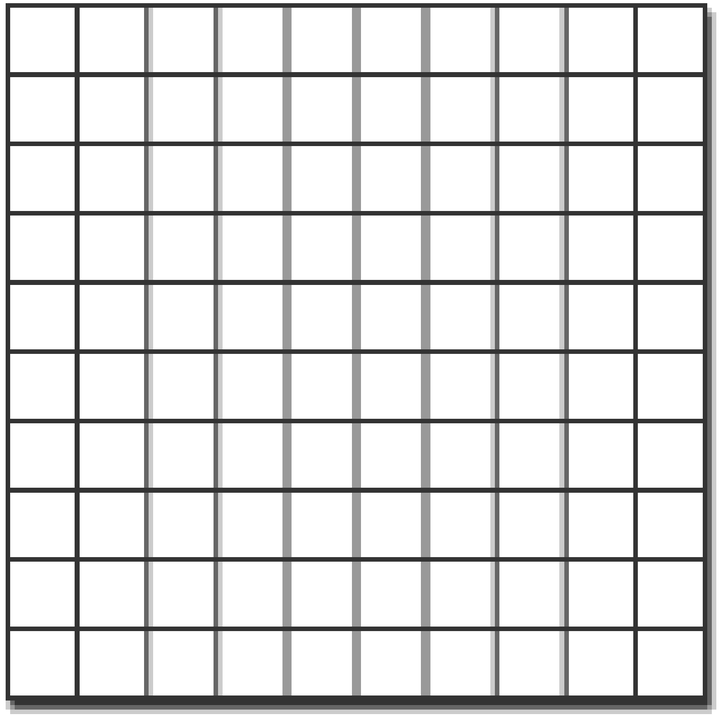
Capturing Existing Conditions – Weather Conditions

What are “ideal” weather conditions?

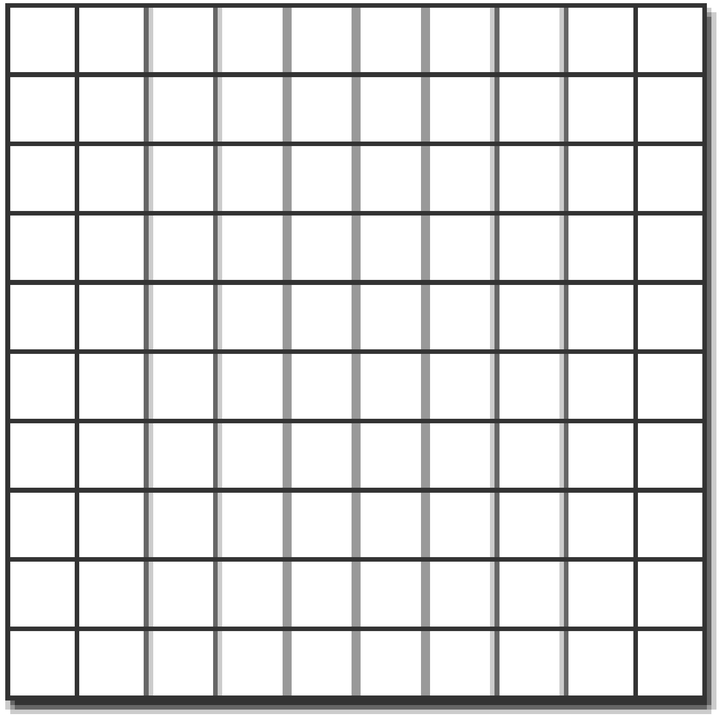
- Avoid bright sunlight
- Avoid long, dark shadows
- If it’s bright and sunny, try to fly when the sun is directly overhead, minimizing long shadows and glare/reflections off windows and shiny surfaces
- Try to avoid water
- Ideal flight conditions = overcast (diffused, evenly distributed lighting)

Capturing Existing Conditions – Shutter Types

Rolling Shutter



Global Shutter
aka Mechanical Shutter



【Global Shutter】

【Rolling Shutter】

Capturing Existing Conditions – GCPs

What are “GCPs”?

- Ground Control Points
- Known survey points
- Help “pull together” a point cloud
- Do you *really* need them?
  - Proposals
  - Site study / Preliminary design
  - Building massing
  - Field verification
  - Stockpile quantities (comparison)


Data Processing

Image Processing with Recap Photo

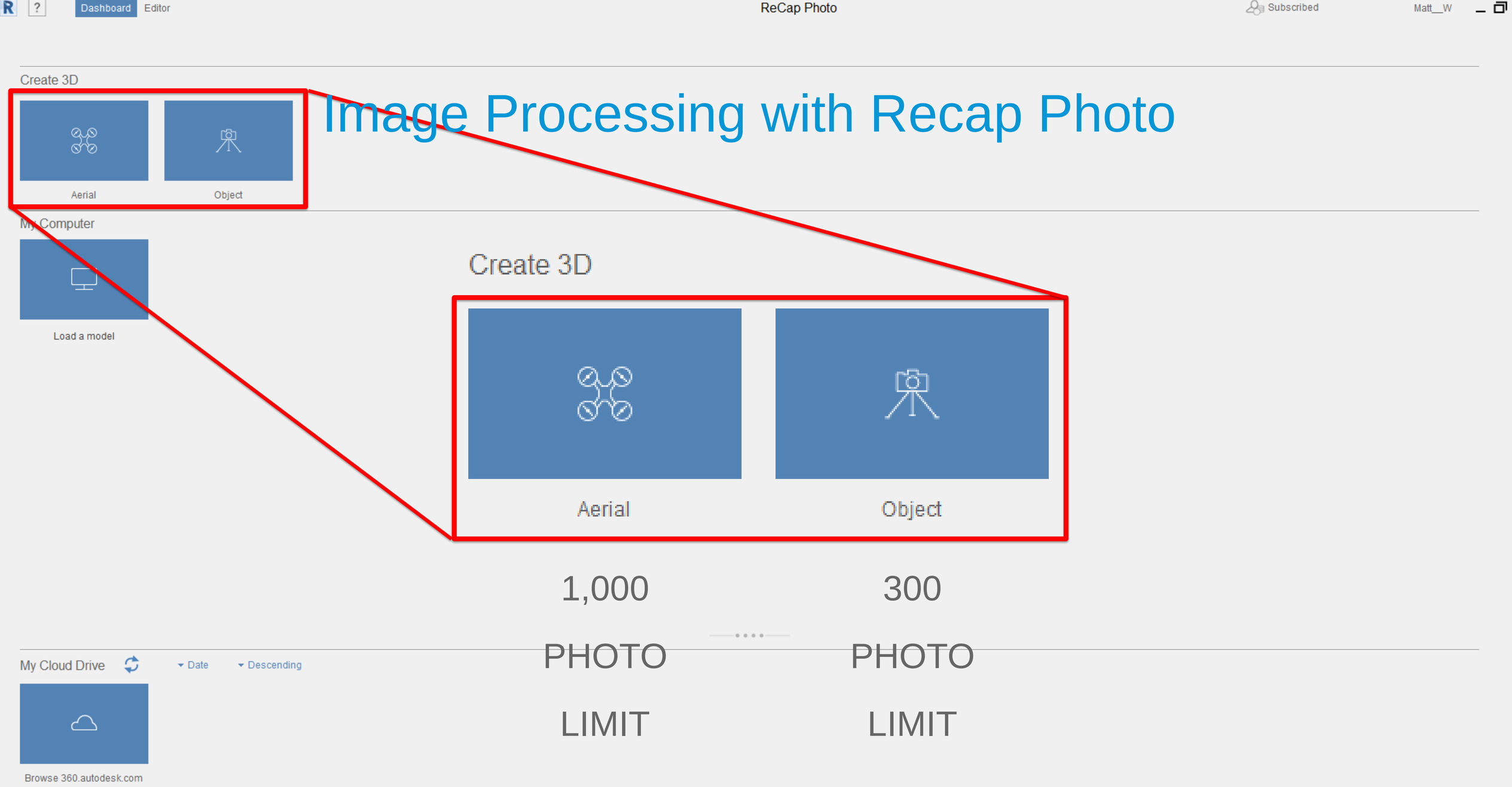
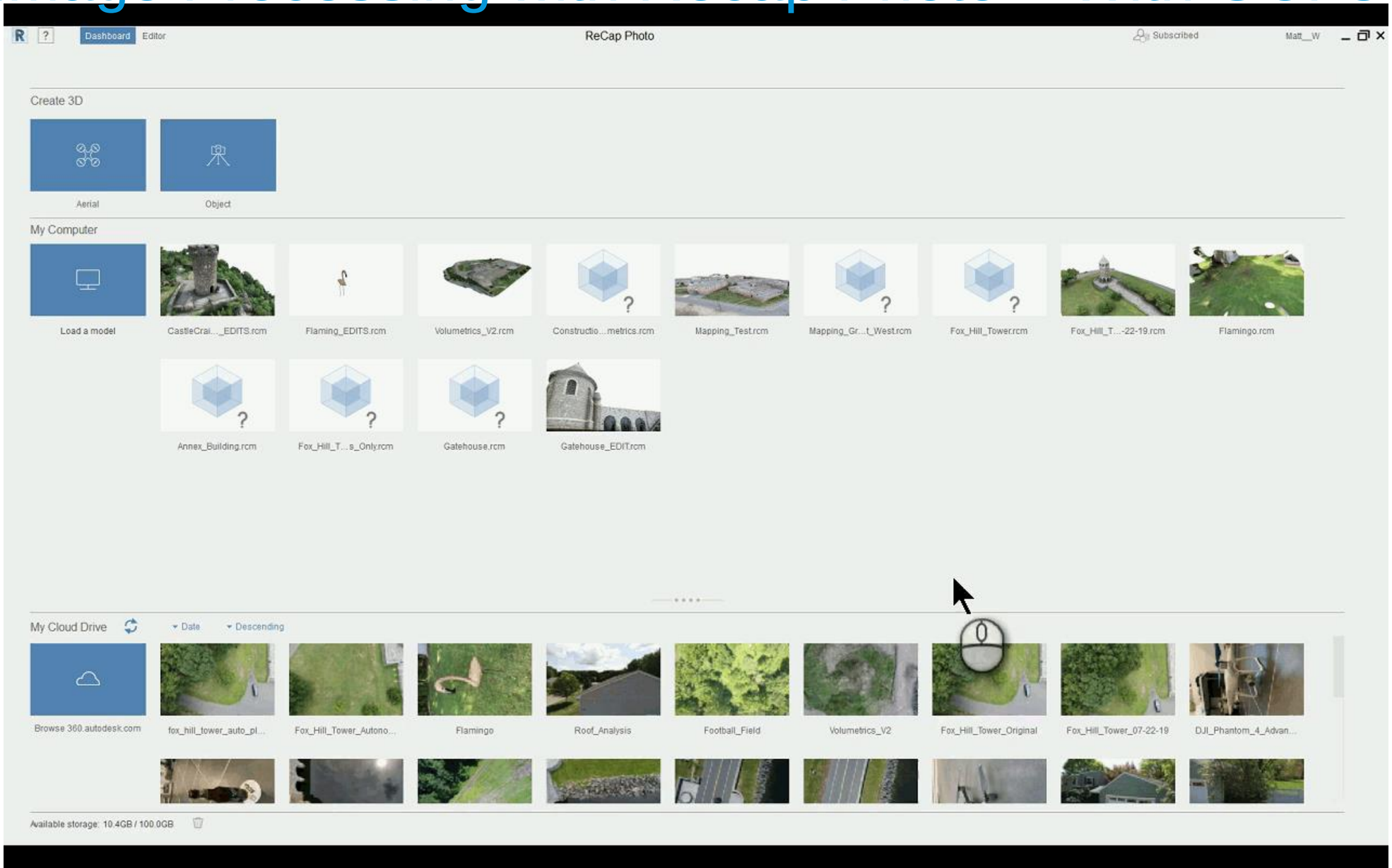


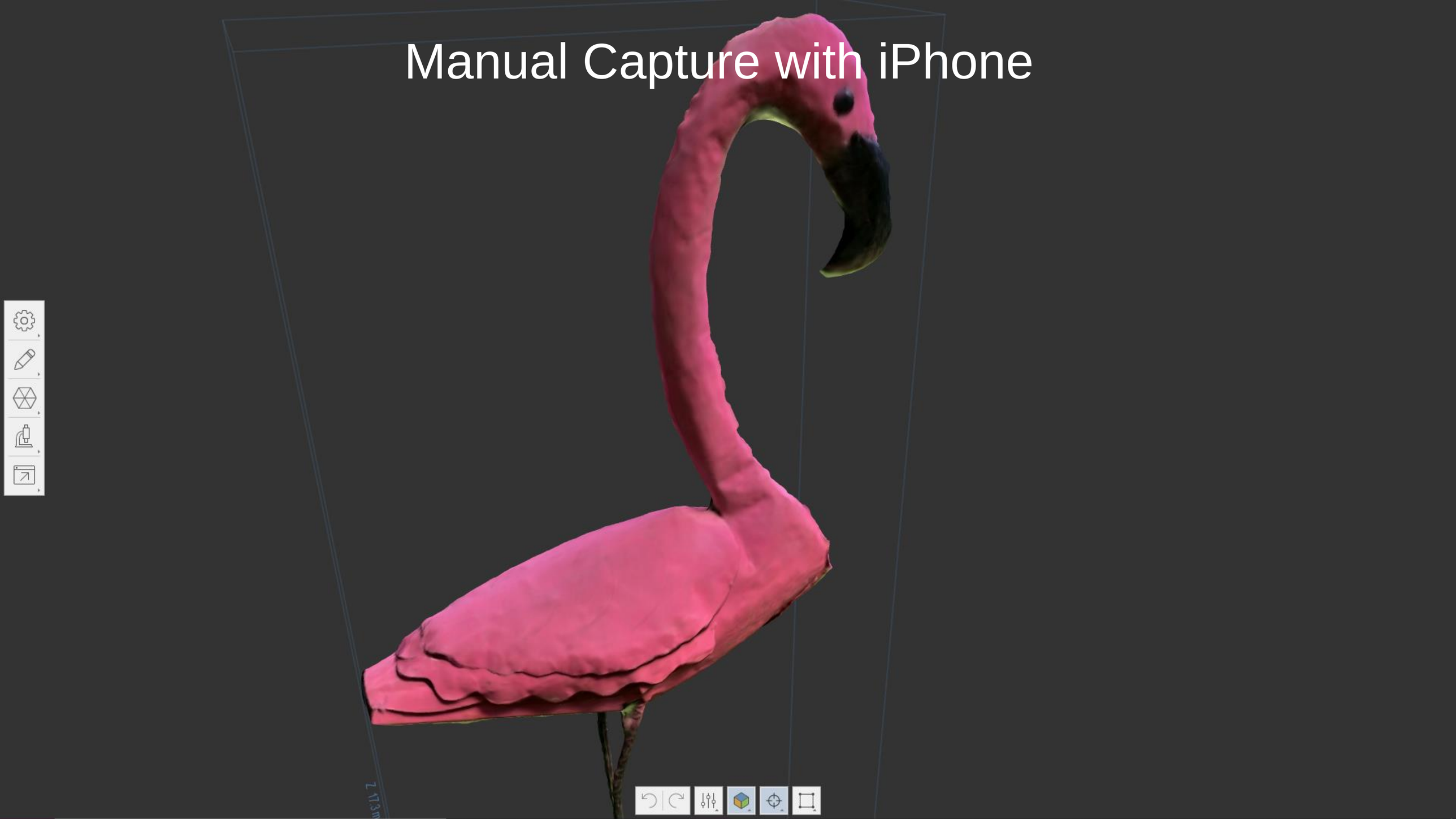
Image Processing with Recap Photo – With GCPs



Results

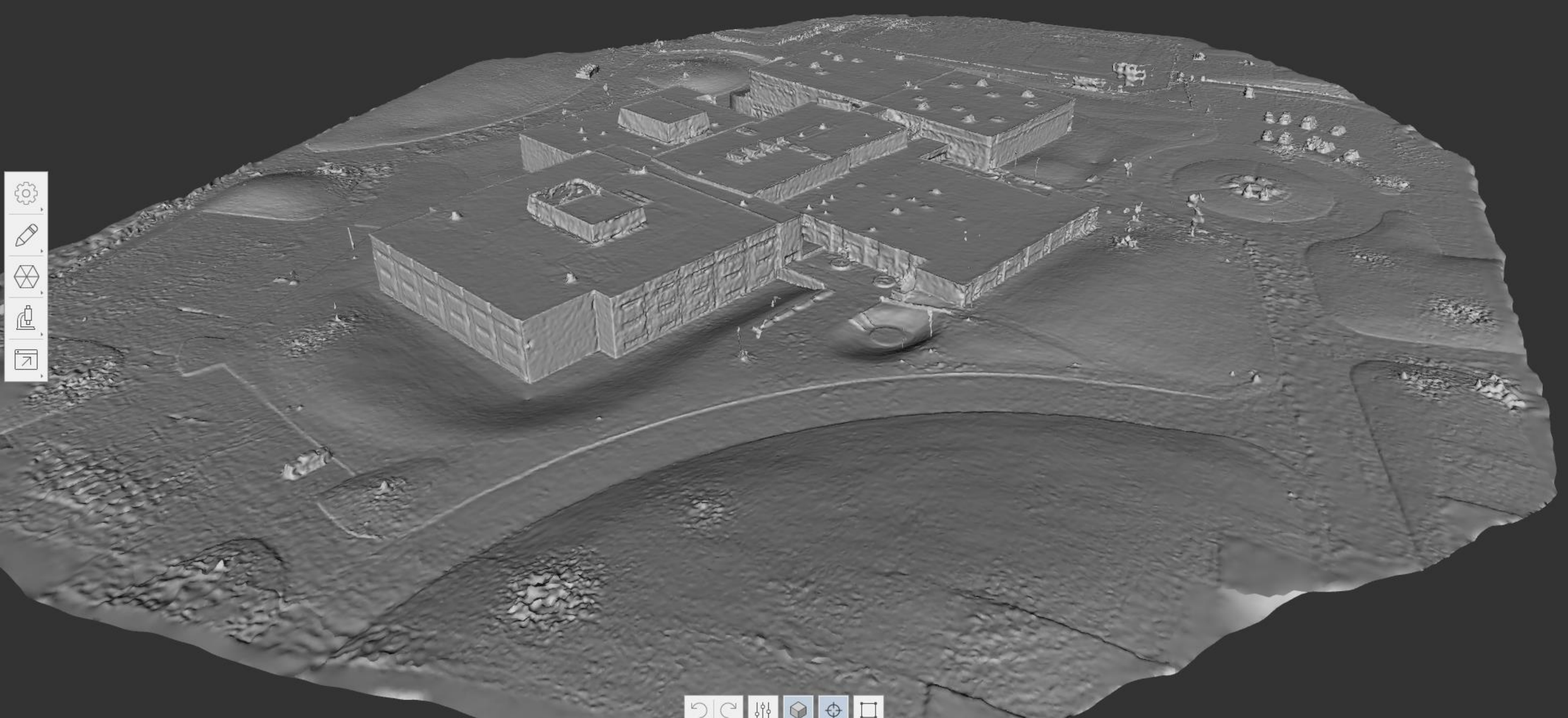

Manual Capture with iPhone

Manual Capture with iPhone



DJI Mavic Pro – Rolling Shutter

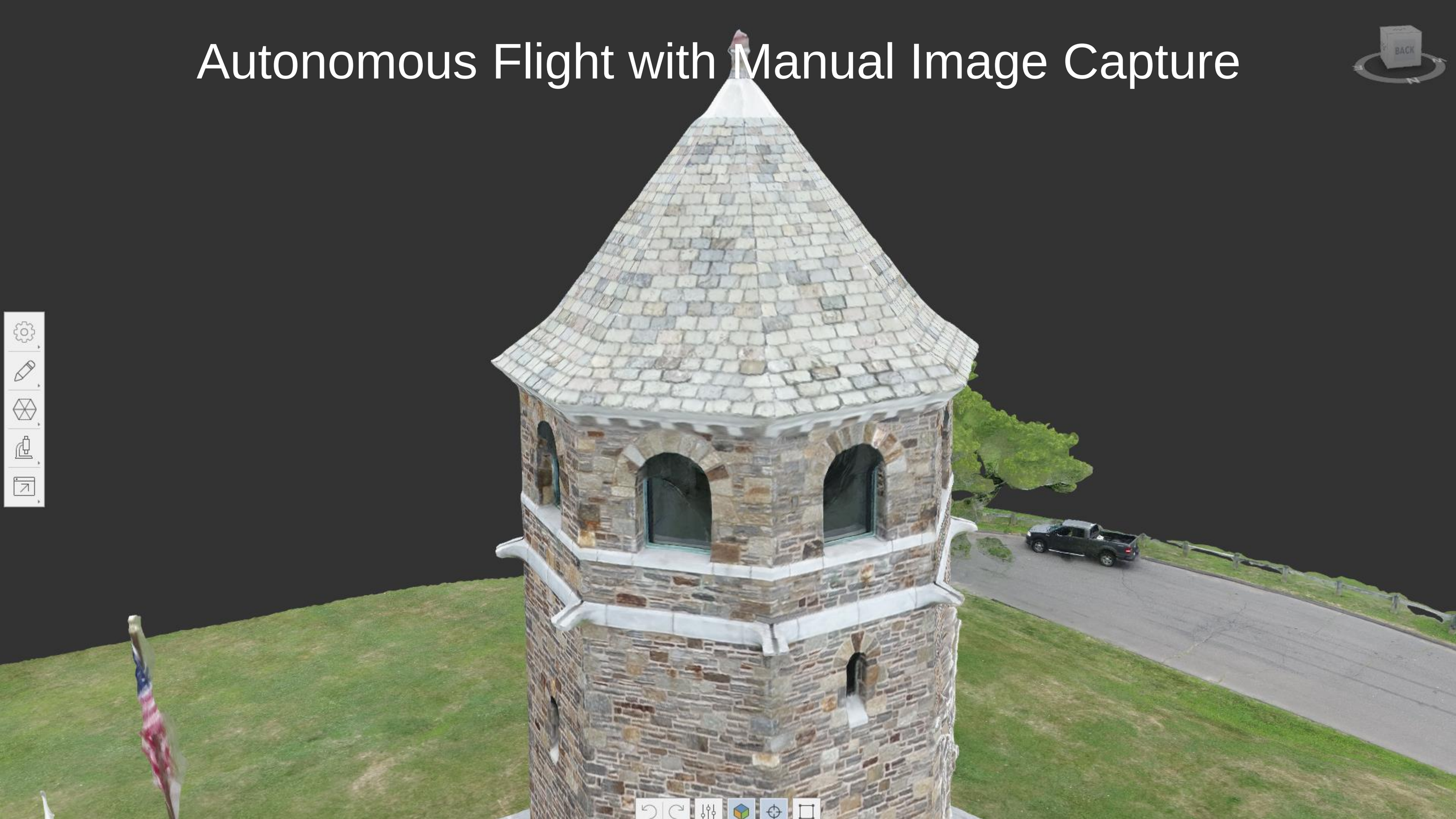
DJI Mavic Pro – Rolling Shutter



Autonomous Flight ONLY

Autonomous Flight with Manual Image Capture

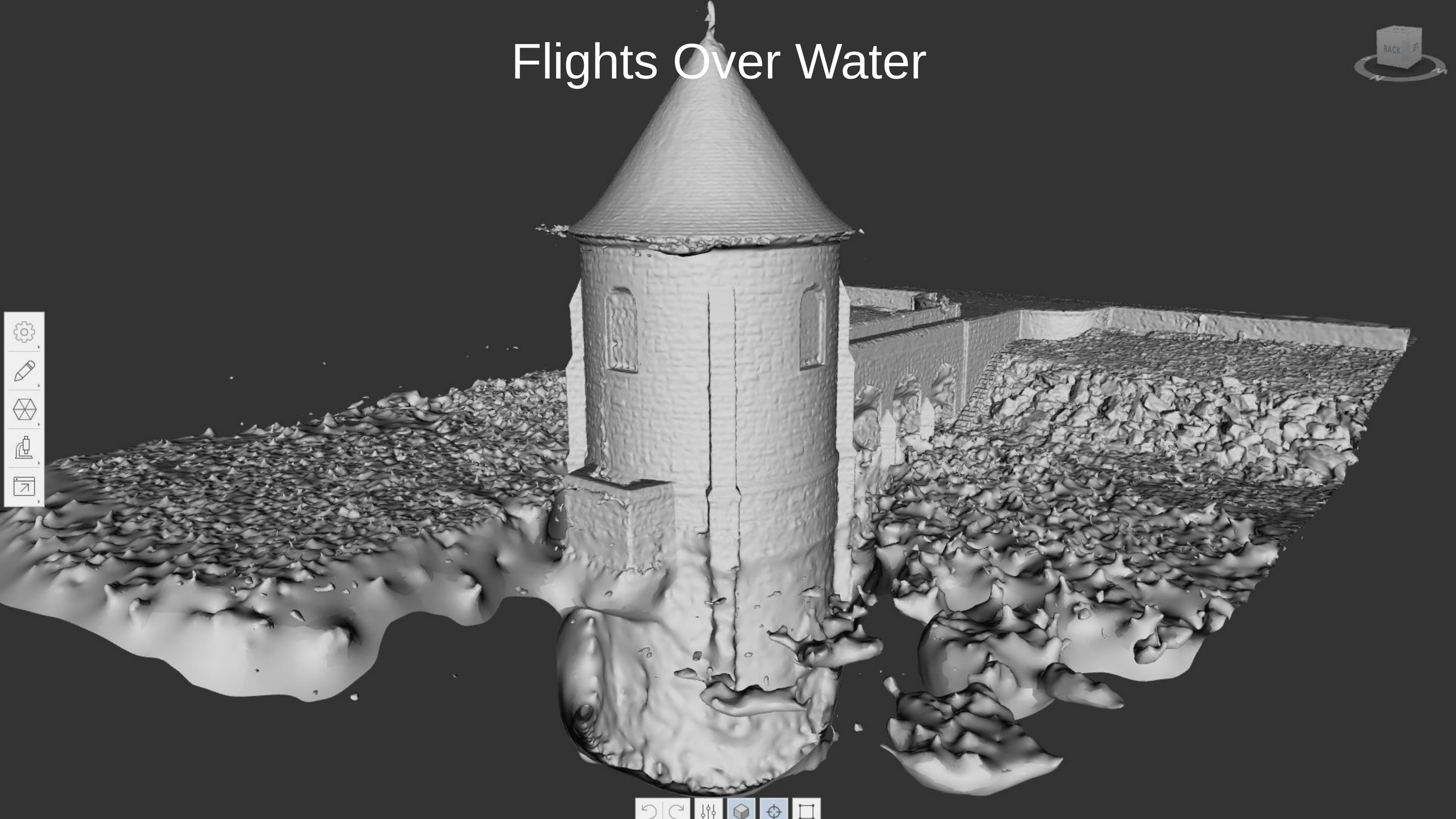
Autonomous Flight with Manual Image Capture



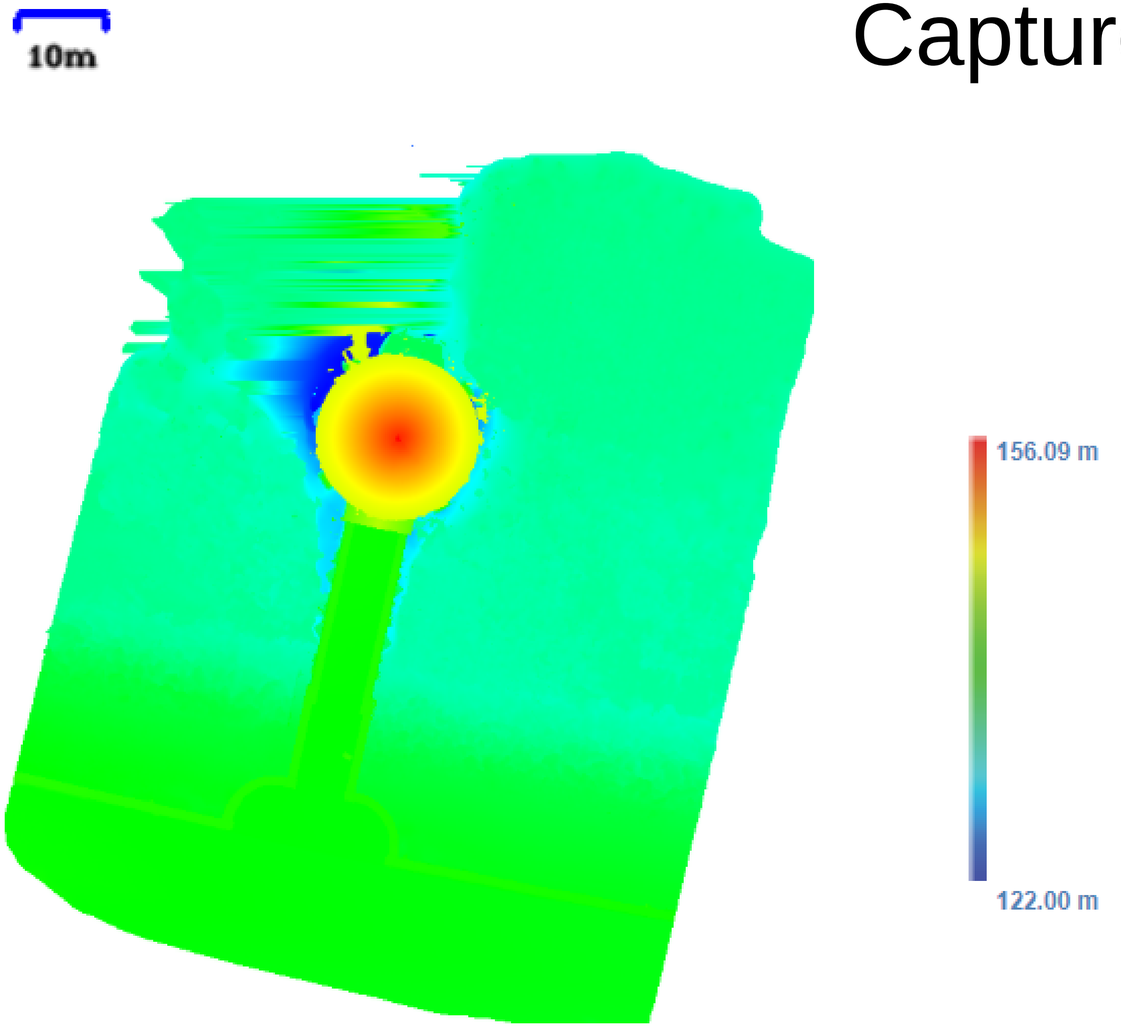
Aerial Photo Locations

Flights Over Water

Flights Over Water



Capture Results

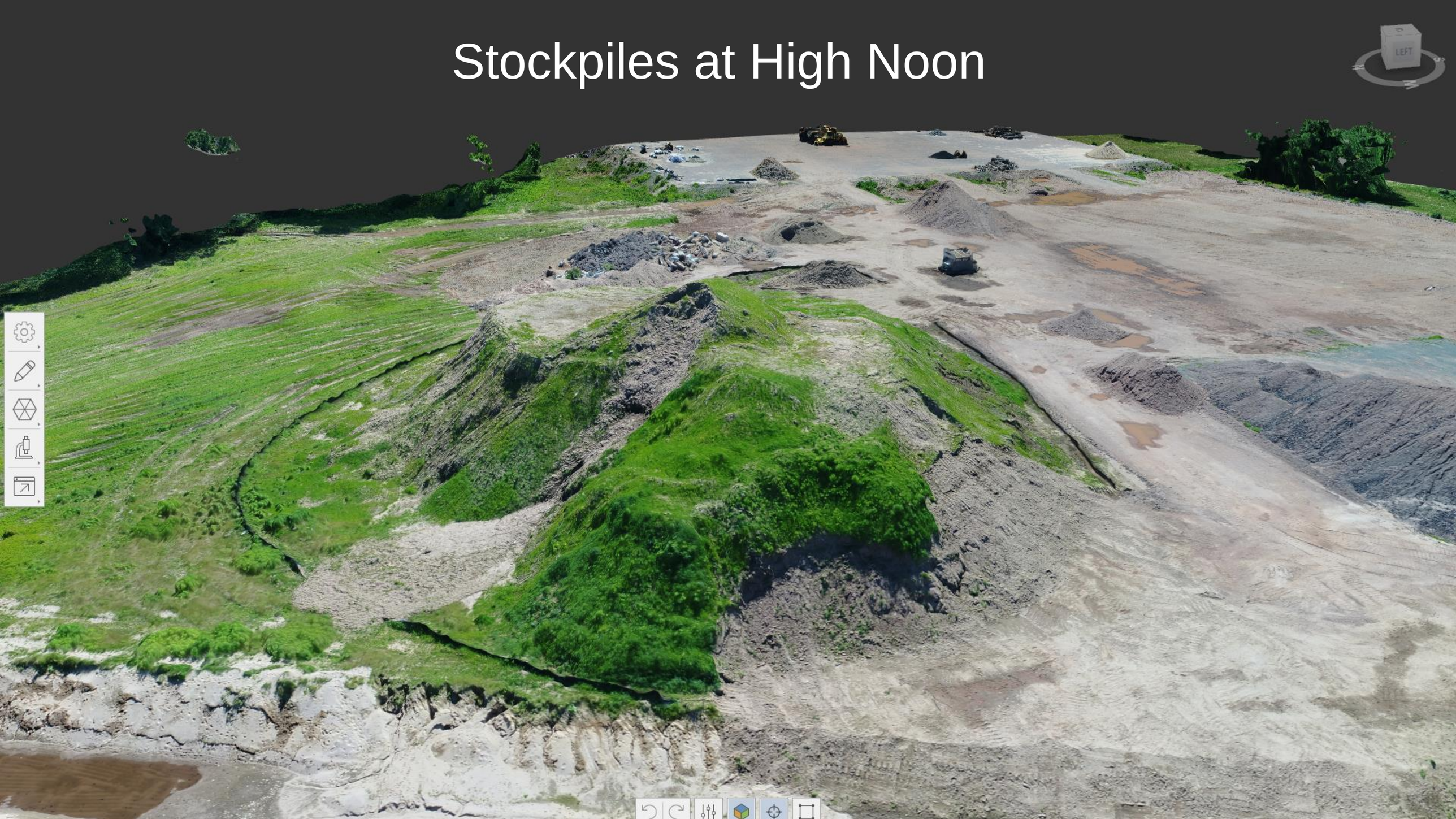


Digital Elevation Model Resolution:
10.00 cm / px

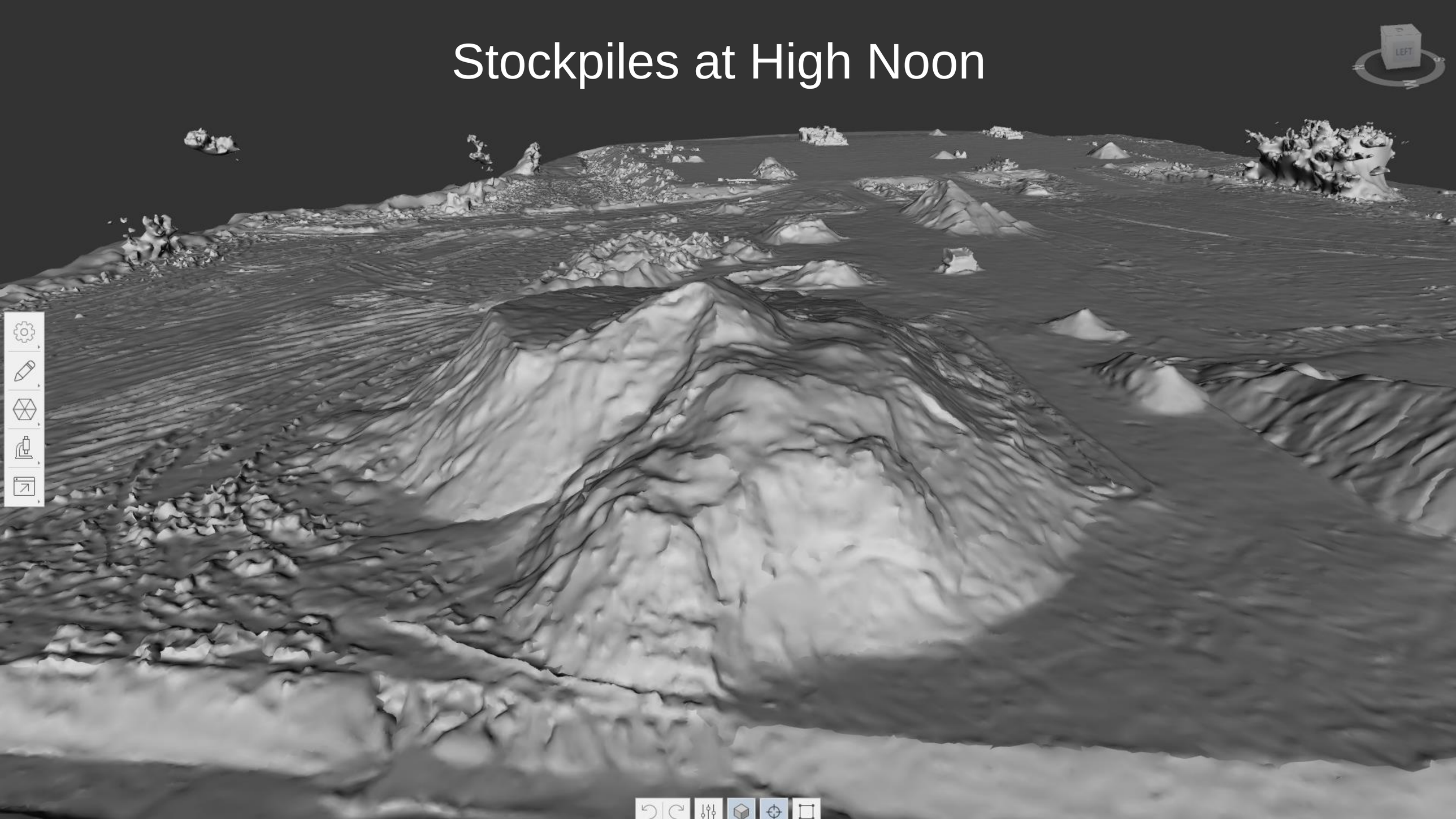
Overlapping images computed for each pixel of the orthomosaic. Red
ates poor overlaps that would generate poor results.
an overlap of more than 5 images for every pixel.

Effective Overlaps:
3.30 images per pair

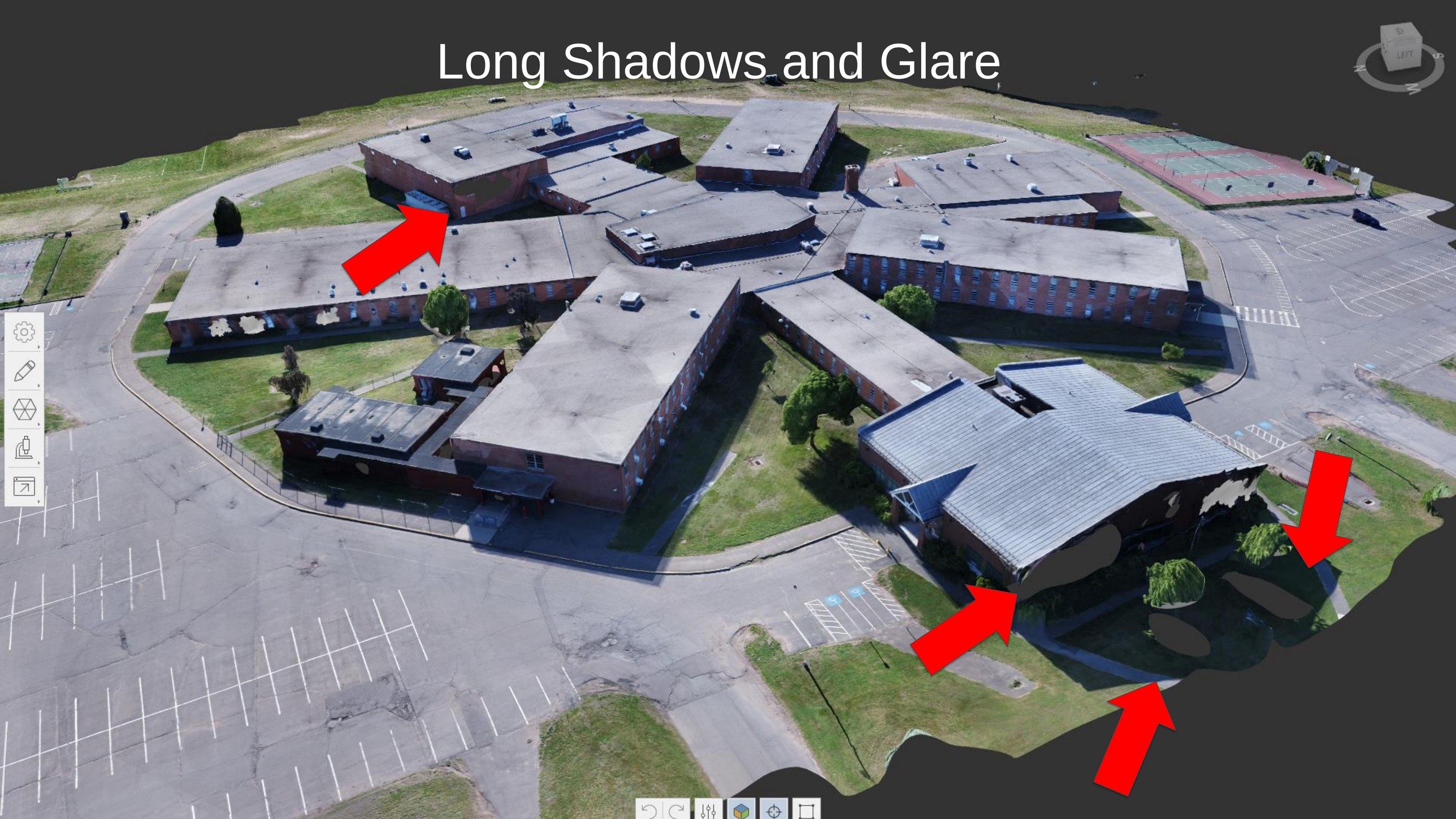
Stockpiles at High Noon



Stockpiles at High Noon

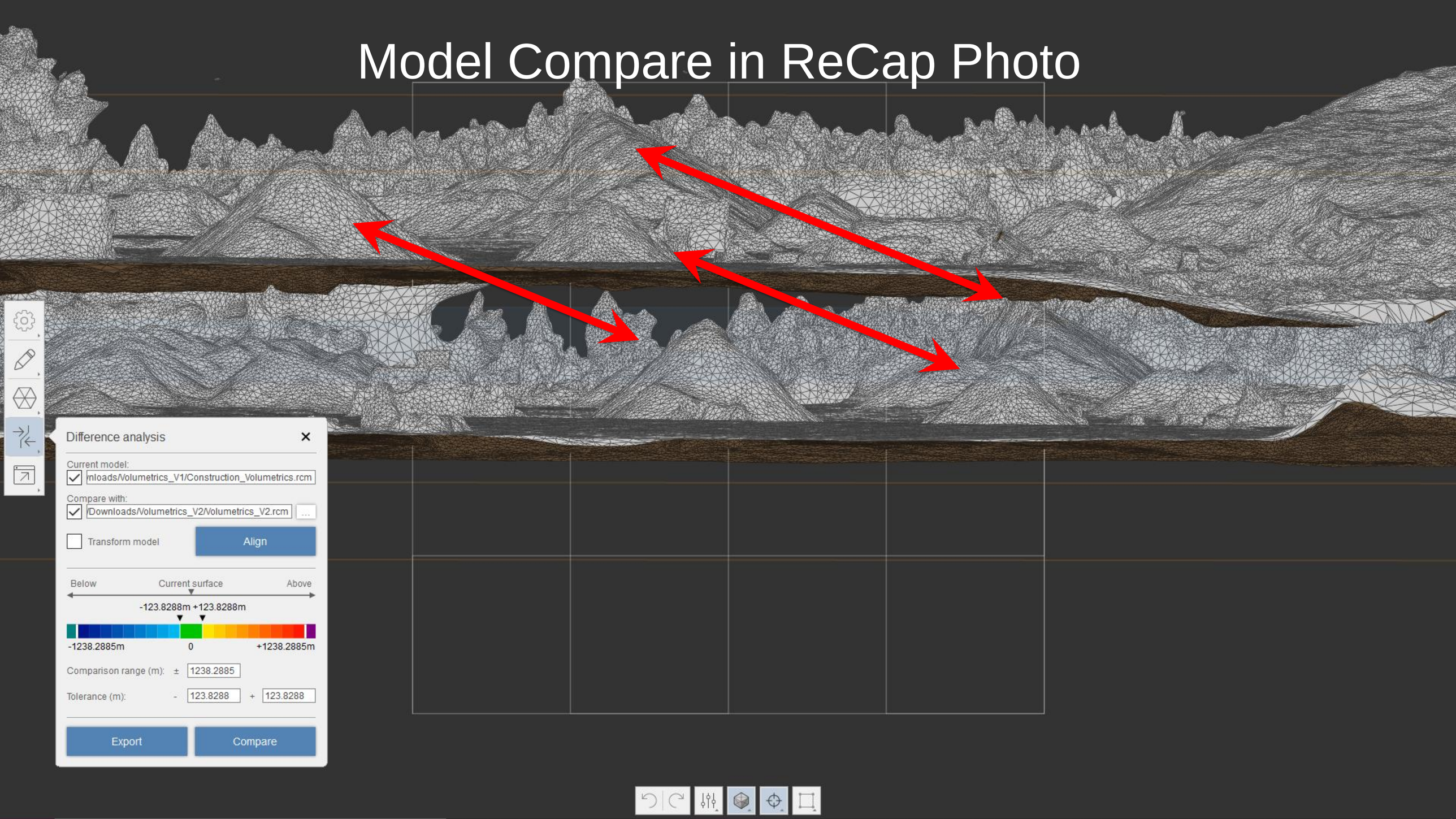


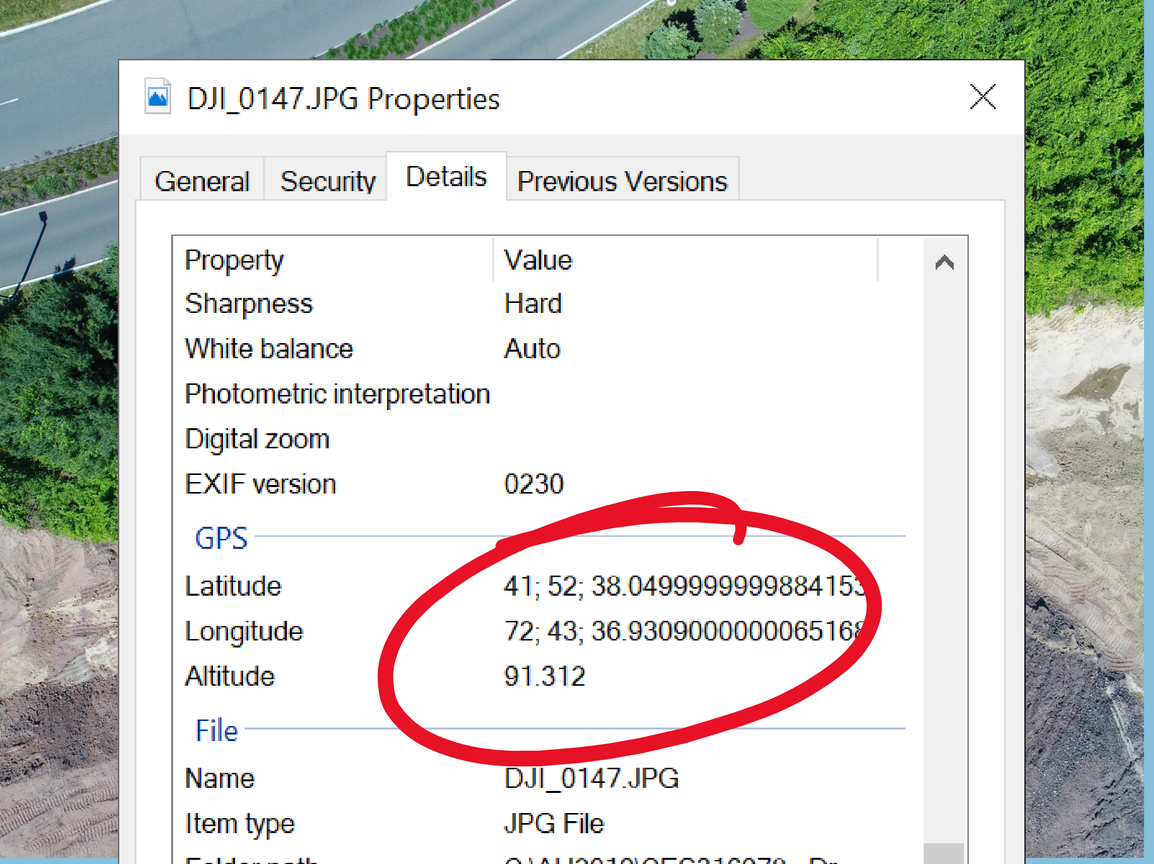
Long Shadows and Glare



Long Shadows and Glare

Model Compare in ReCap Photo





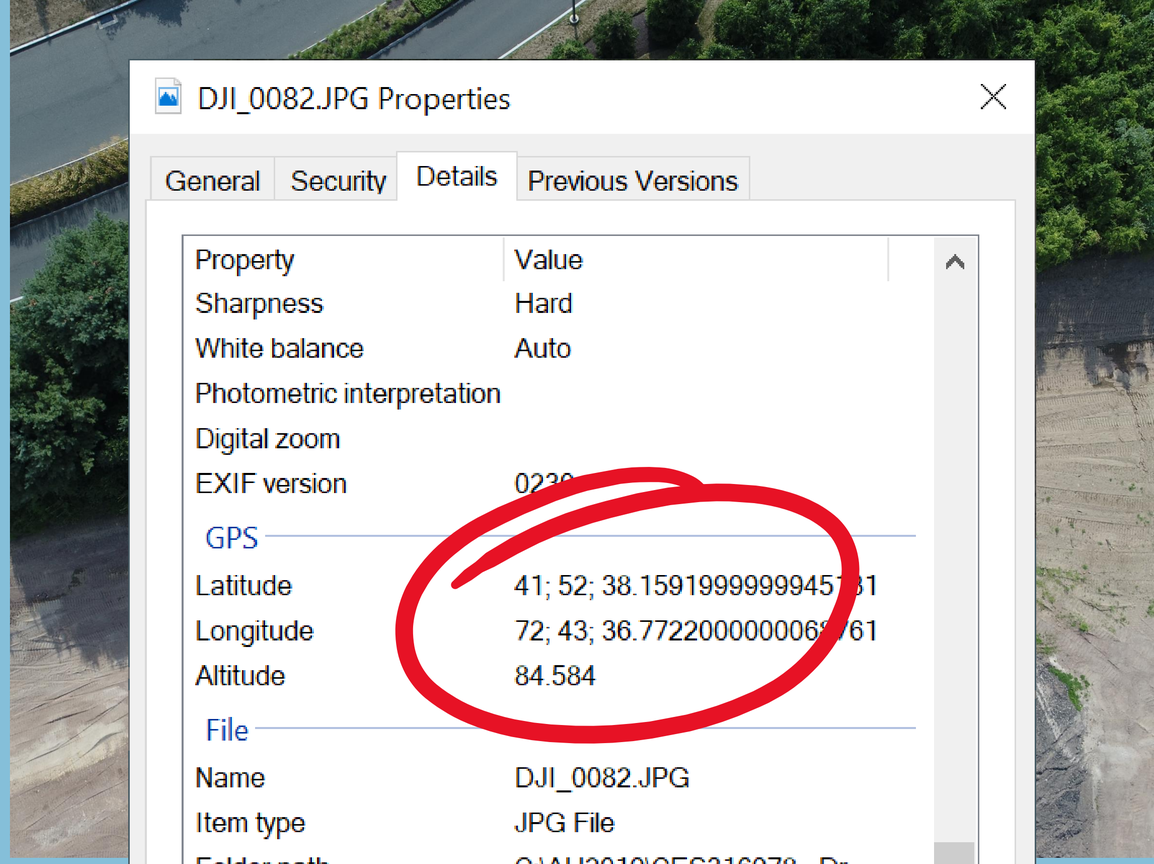
DJI_0147.JPG Properties

General | Security | Details | Previous Versions

Property	Value
Sharpness	Hard
White balance	Auto
Photometric interpretation	
Digital zoom	
EXIF version	0230
GPS	
Latitude	41; 52; 38.0499999999884153
Longitude	72; 43; 36.9309000000065168
Altitude	91.312
File	
Name	DJI_0147.JPG
Item type	JPG File
Folder path	C:\AU2019\CES316978 - Dr...
Date created	9/3/2019 7:07 PM
Date modified	6/23/2019 10:28 AM
Size	7.24 MB
Attributes	A
Availability	
Offline status	

Remove Properties and Personal Information

OK | Cancel | Apply



DJI_0082.JPG Properties

General | Security | Details | Previous Versions

Property	Value
Sharpness	Hard
White balance	Auto
Photometric interpretation	
Digital zoom	
EXIF version	0230
GPS	
Latitude	41; 52; 38.1591999999945761
Longitude	72; 43; 36.7722000000068761
Altitude	84.584
File	
Name	DJI_0082.JPG
Item type	JPG File
Folder path	C:\AU2019\CES316978 - Dr...
Date created	9/3/2019 7:08 PM
Date modified	7/28/2019 4:41 PM
Size	7.67 MB
Attributes	A
Availability	
Offline status	

Remove Properties and Personal Information

OK | Cancel | Apply

age Comparis

Output

Available Files for Download

RCM – Mesh File

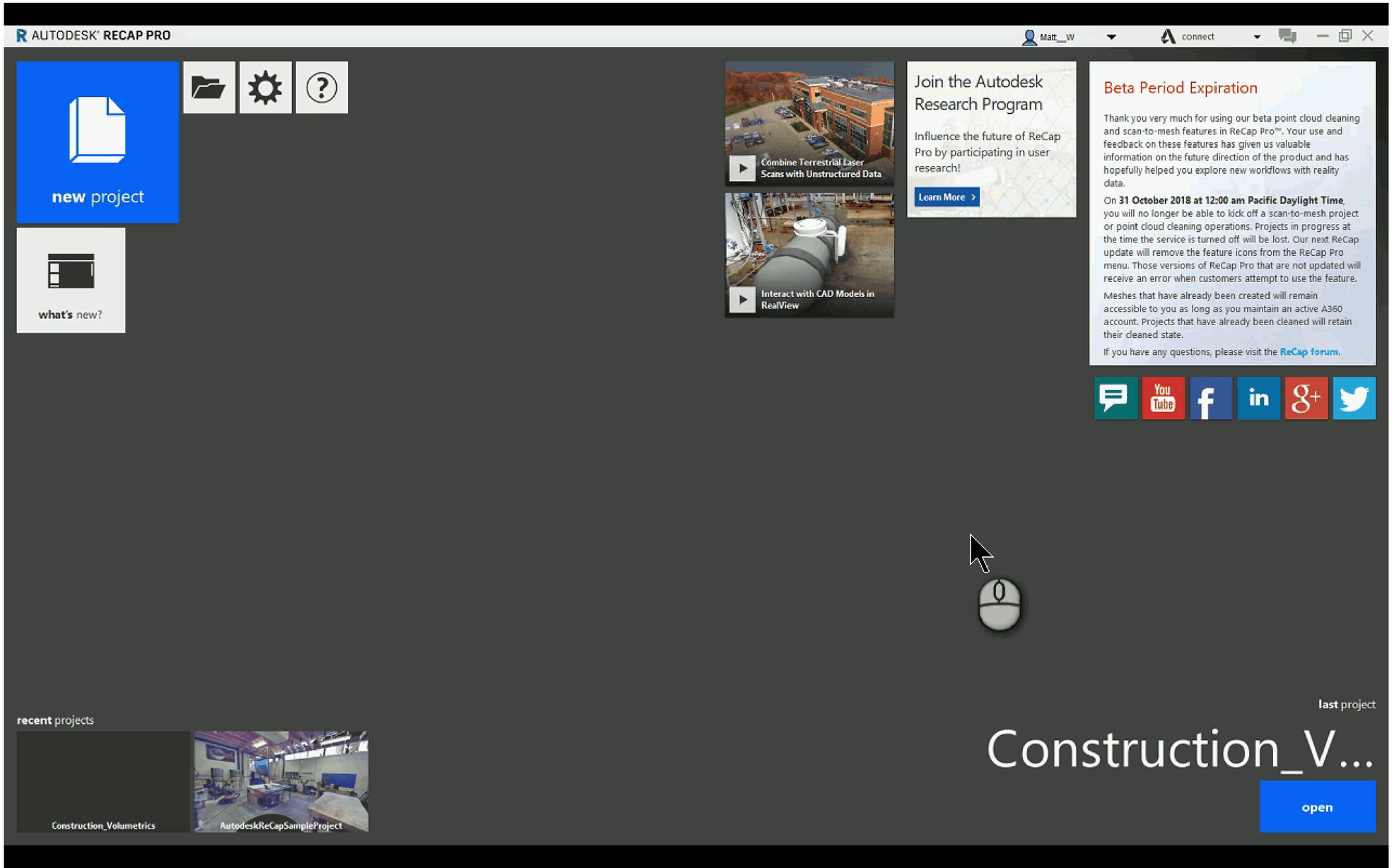
RCS – ReCap Point Cloud

TIF – OrthoTIF (Raster Image)

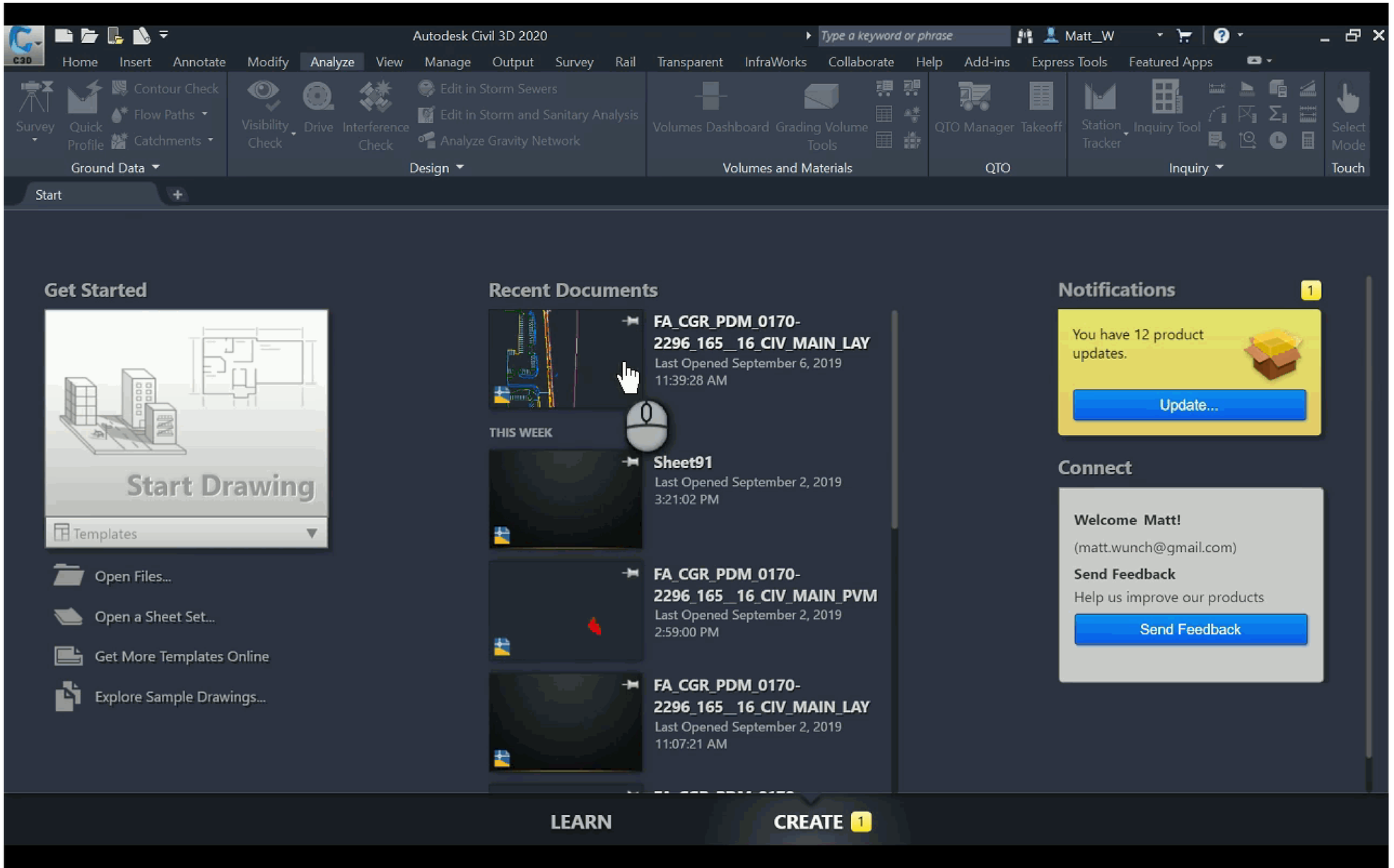
TIF – OrthoDEM (Digital Elevation Model)

Okay…… now what??

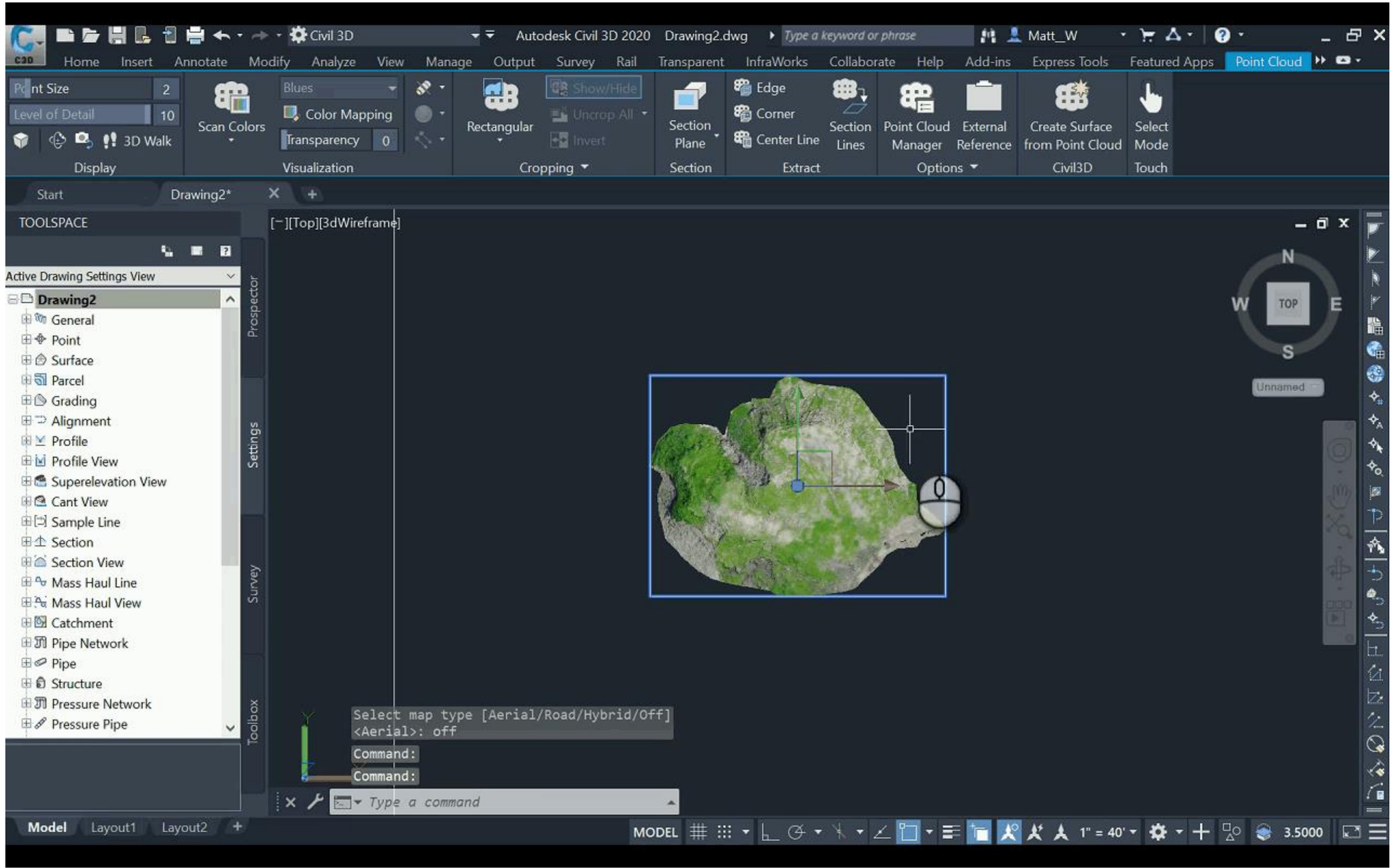
ReCap Pro – Prep / Trim Point Cloud



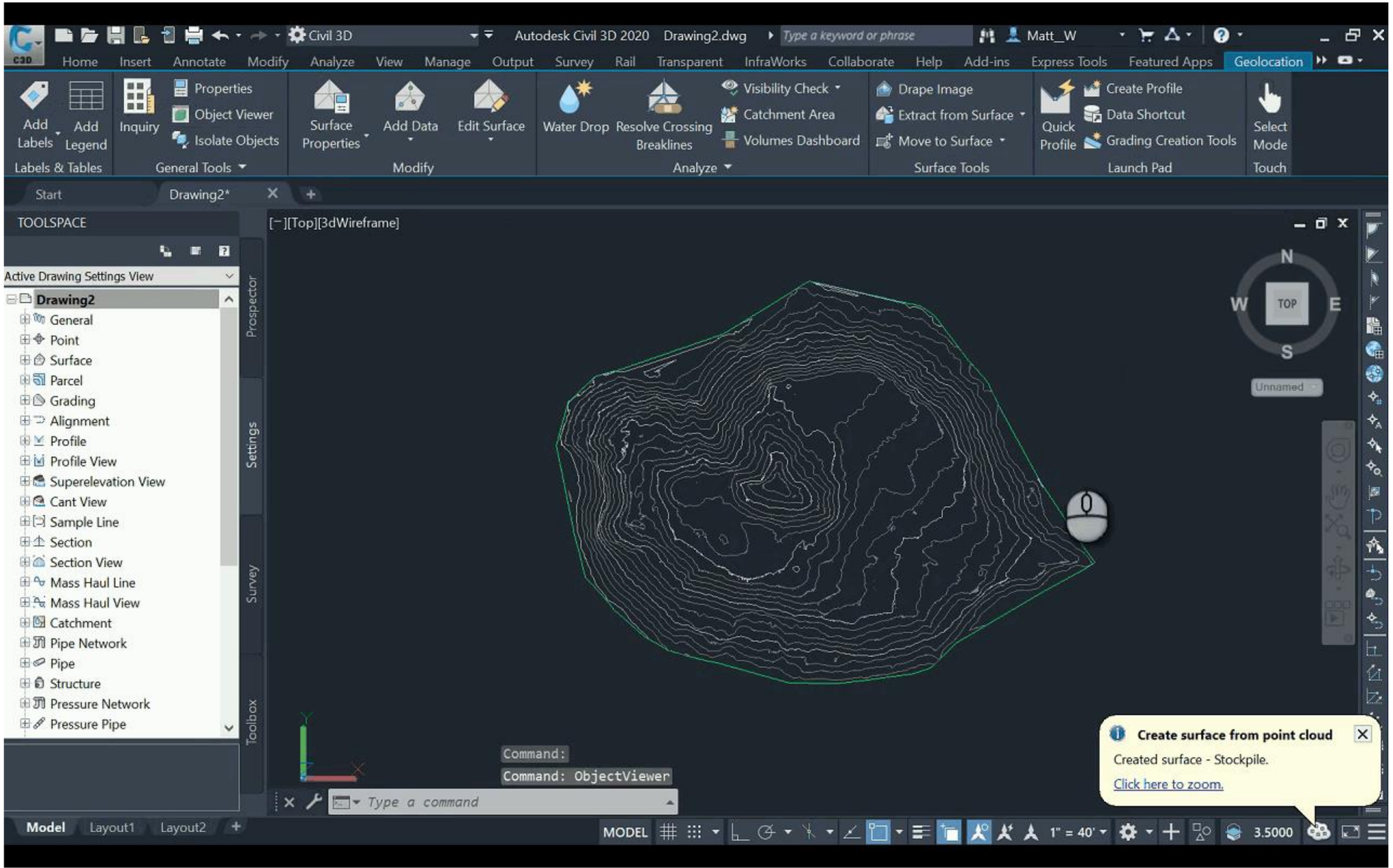
Civil 3D – Reference Point Cloud



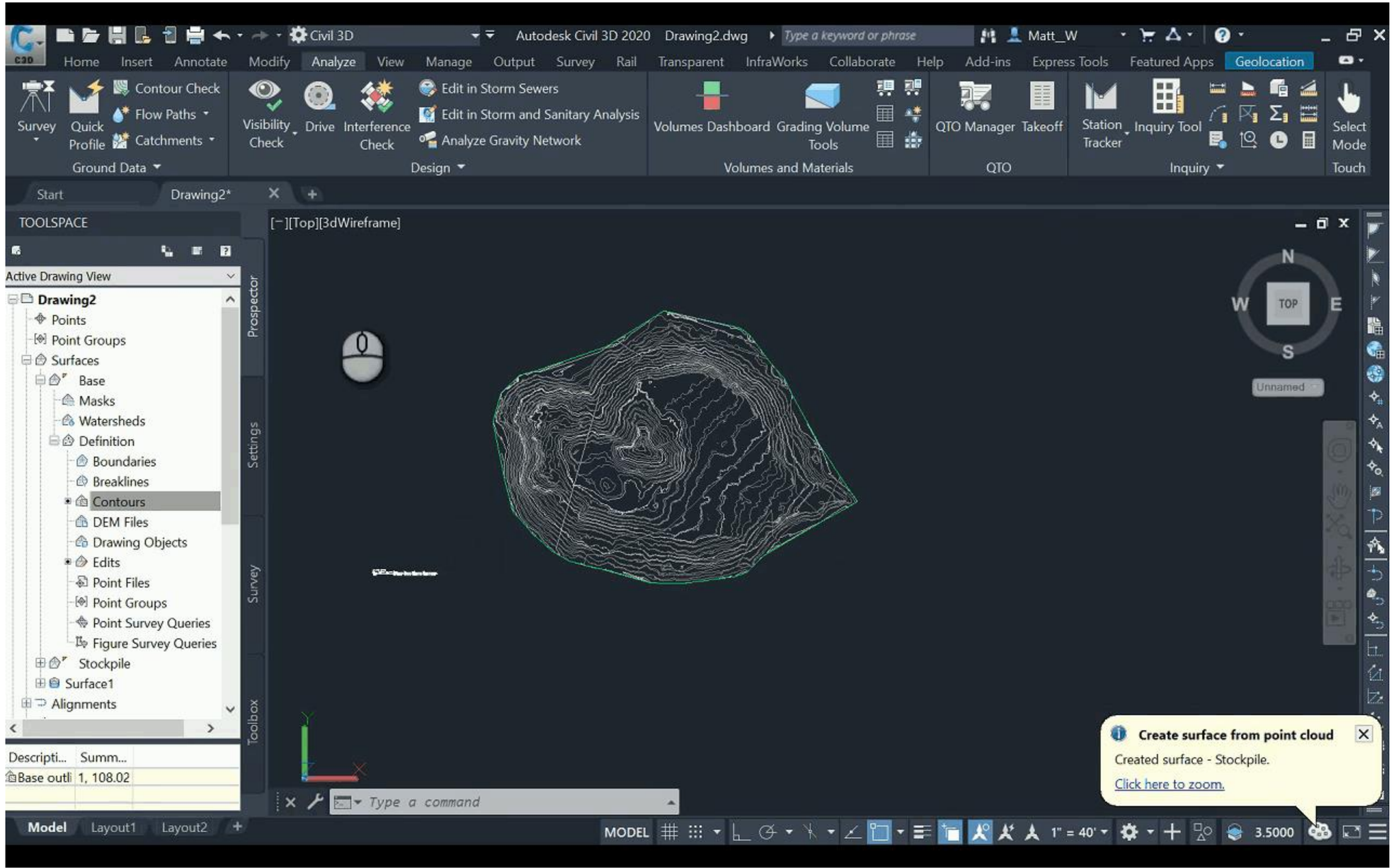
Civil 3D – Create Surface



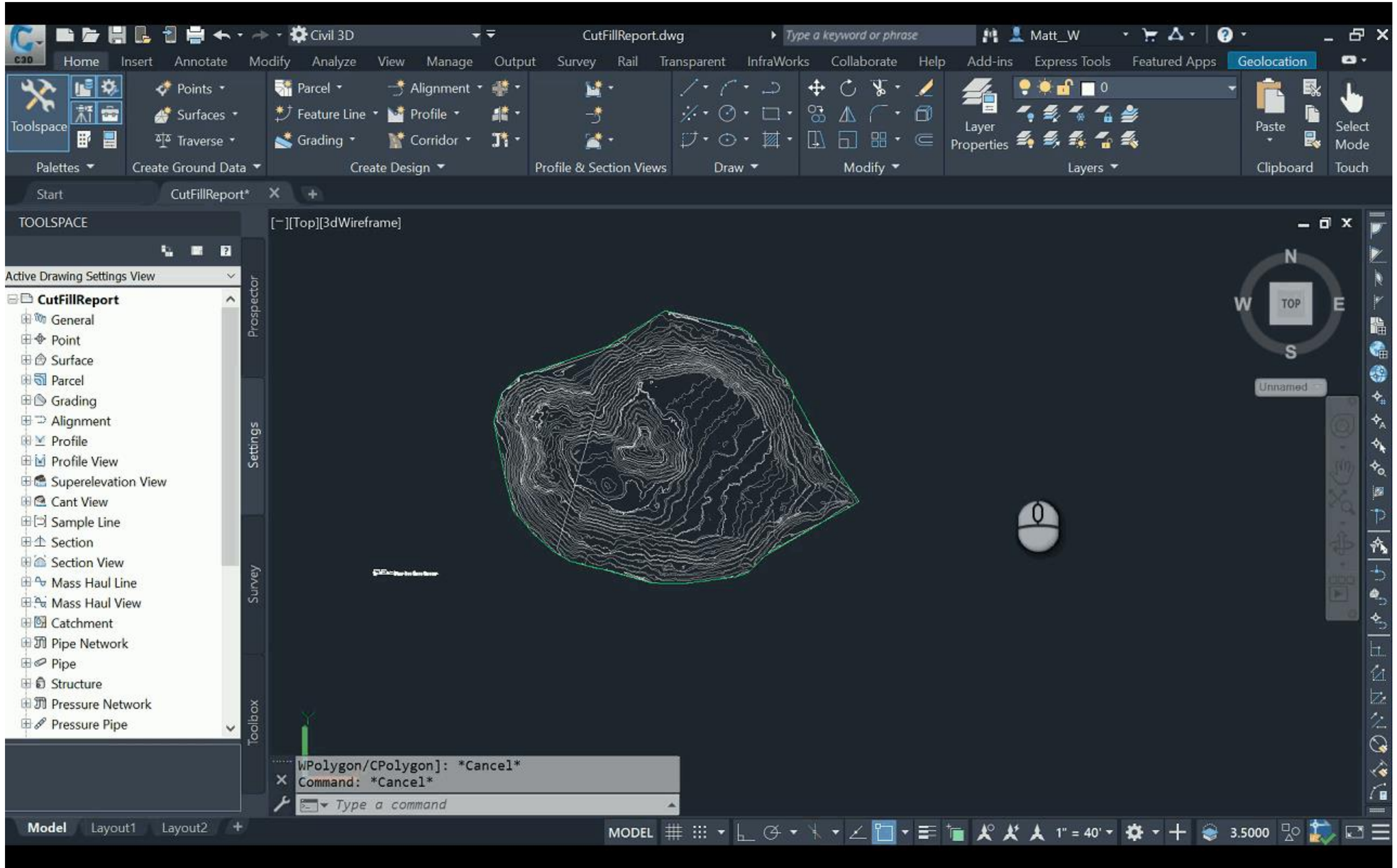
Civil 3D – Surface Comparison



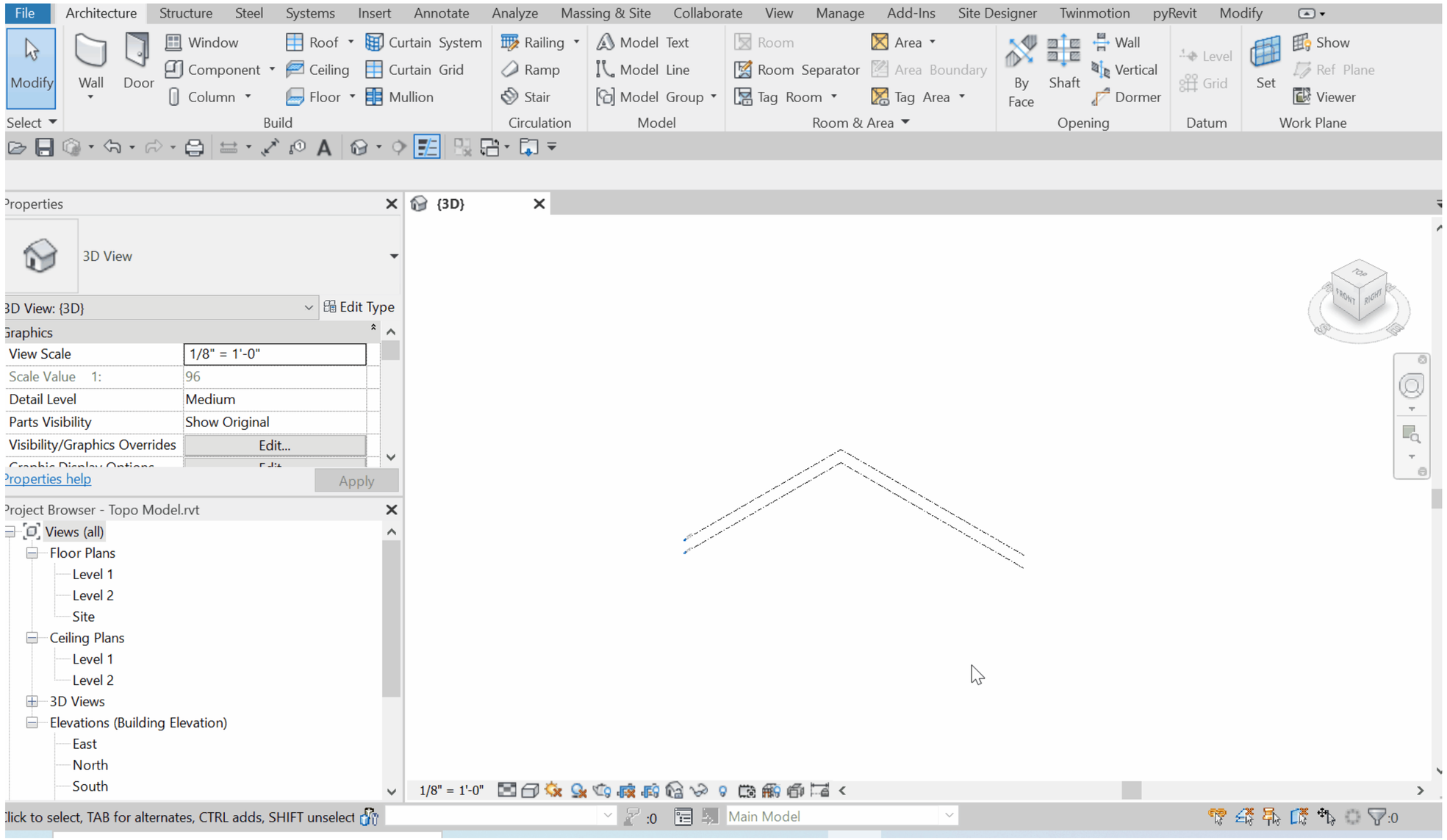
Civil 3D – Publish Surface



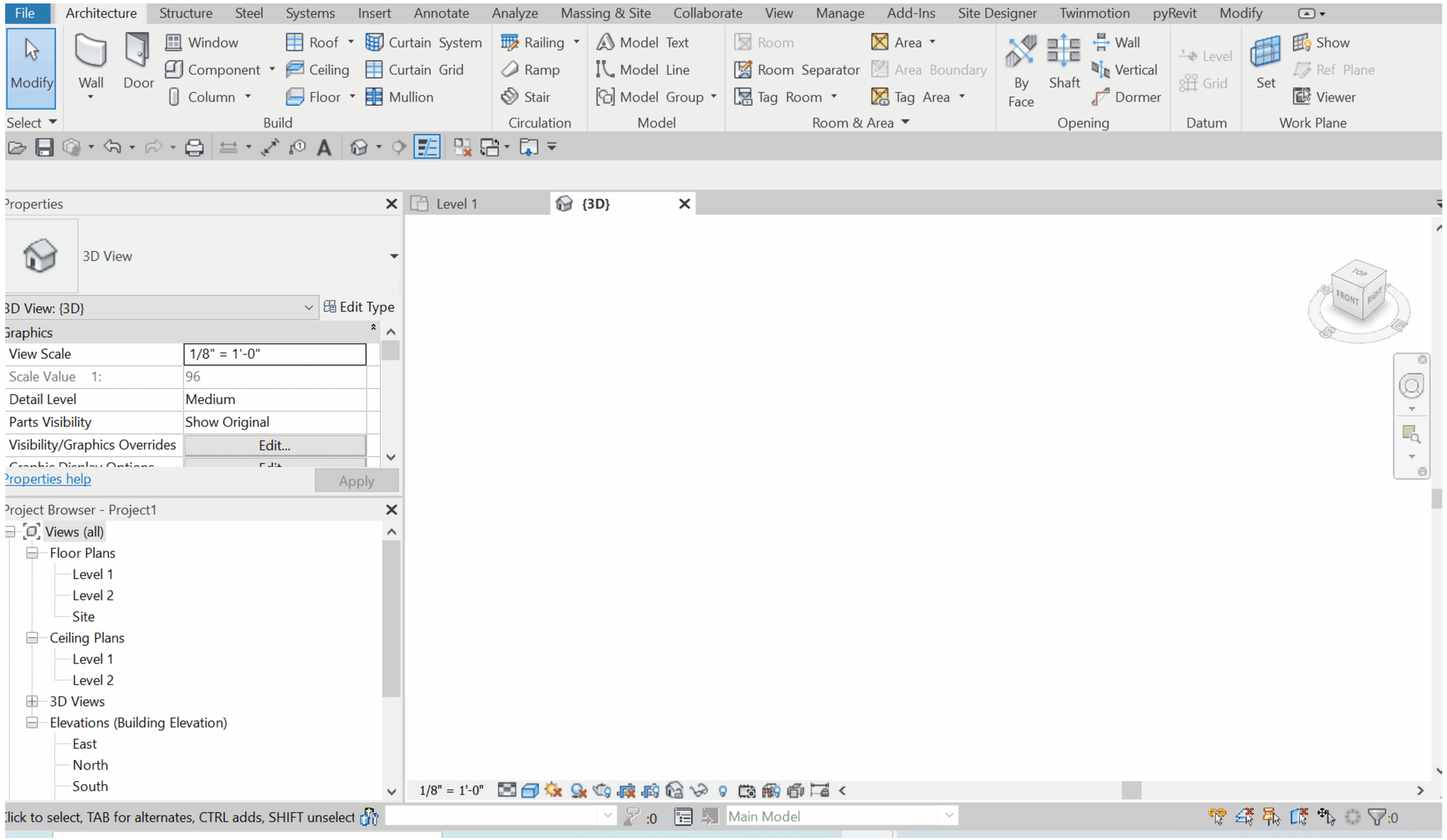
Civil 3D – Export LandXML



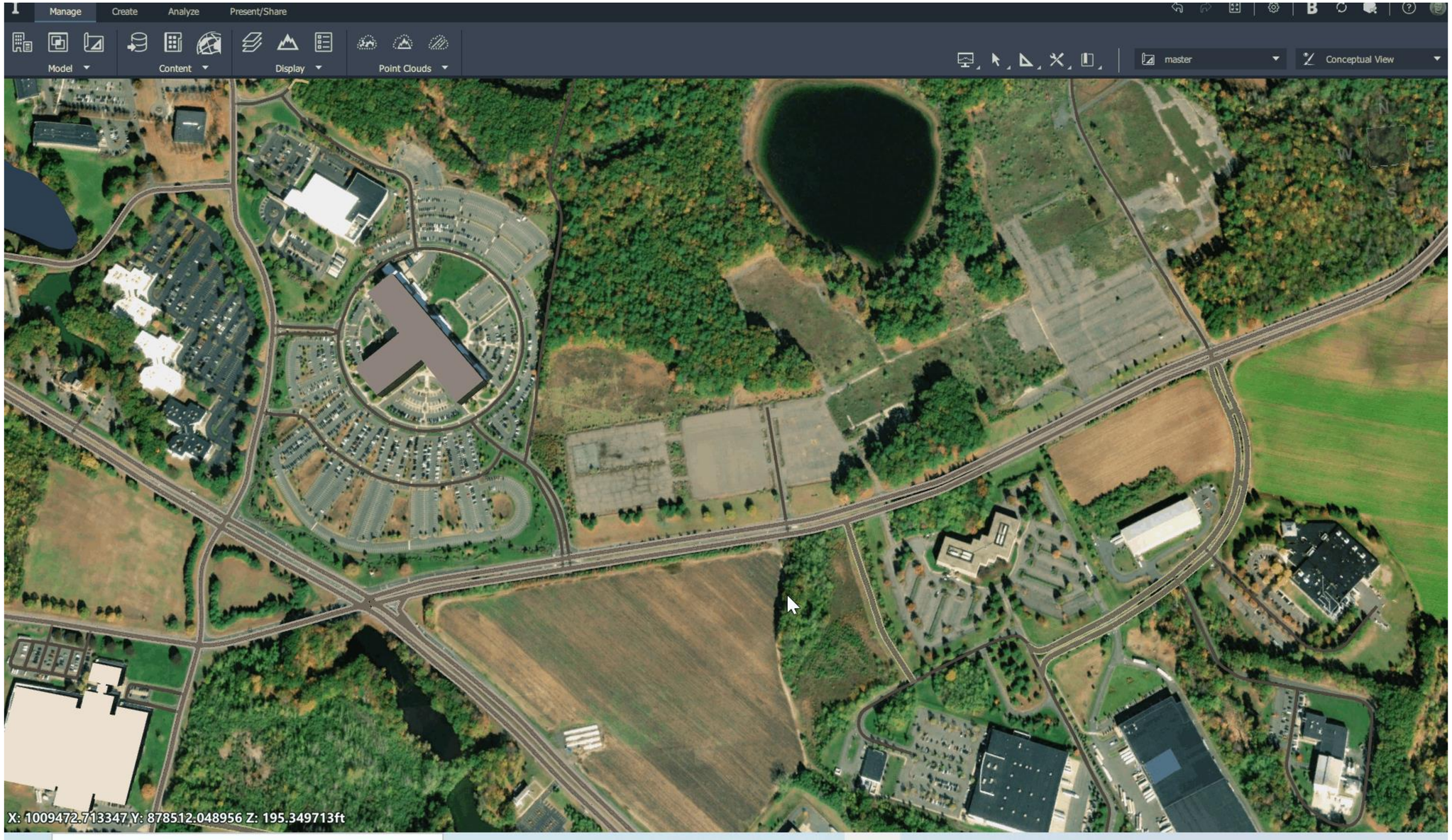
Revit – Import Surface – Desktop Connector



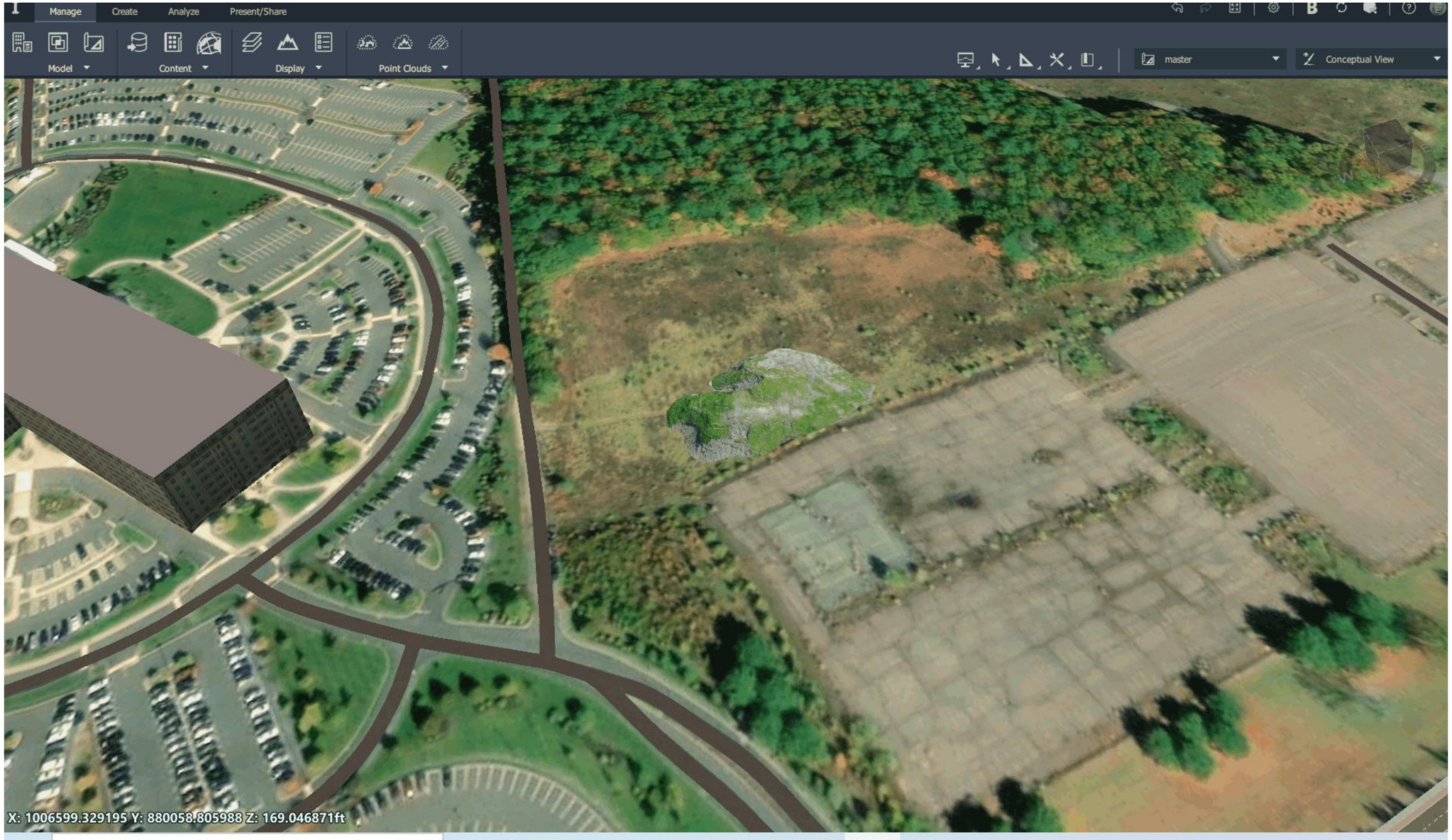
Revit – Import Surface – LandXML



InfraWorks – Import Point Cloud / Ortho TIF



InfraWorks – Convert Point Cloud to Terrain



InfraWorks – Massing

InfraWorks – Massing

Revit – Existing Conditions

Saville Dam.rvt - 3D View: {3D} Copy 2

Matt_W

File | Architecture | Structure | Steel | Systems | Insert | pyRevit | Modify | Walls

Modify | Select | Properties | Clipboard | Geometry | Modify | View | Measure | Create | Mode | Modify Wall

Cope | Cut | Join | Paste | Edit Profile | Reset Profile | Wall Opening | Attach Top/Base | Detach Top/Base

Modify | Walls

Properties

Basic Wall
Generic - 6" Masonry

Walls (1) | Edit Type

Constraints

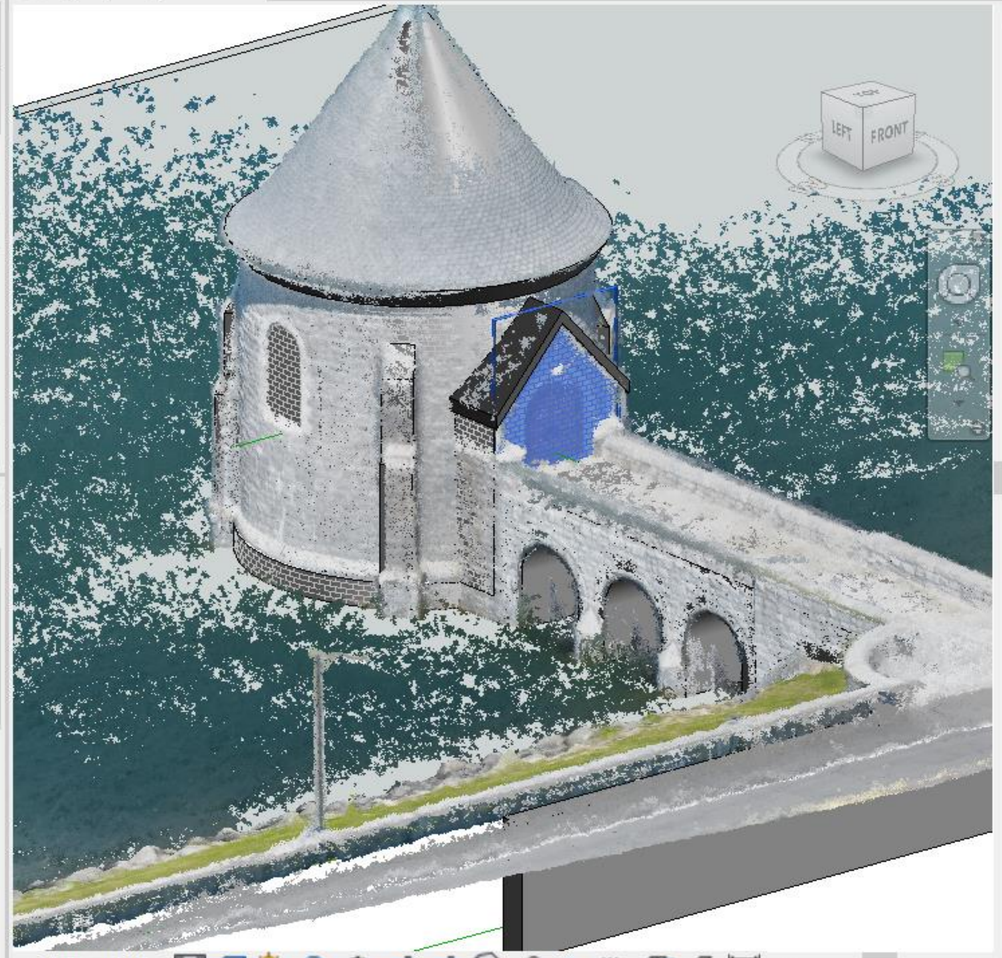
Location Line	Finish Face: Exteric
Base Constraint	Reservoir
Base Offset	0' 0"
Base is Attached	
Base Extension Di...	0' 0"

Properties help | Apply

Project Browser - Saville Dam.rvt

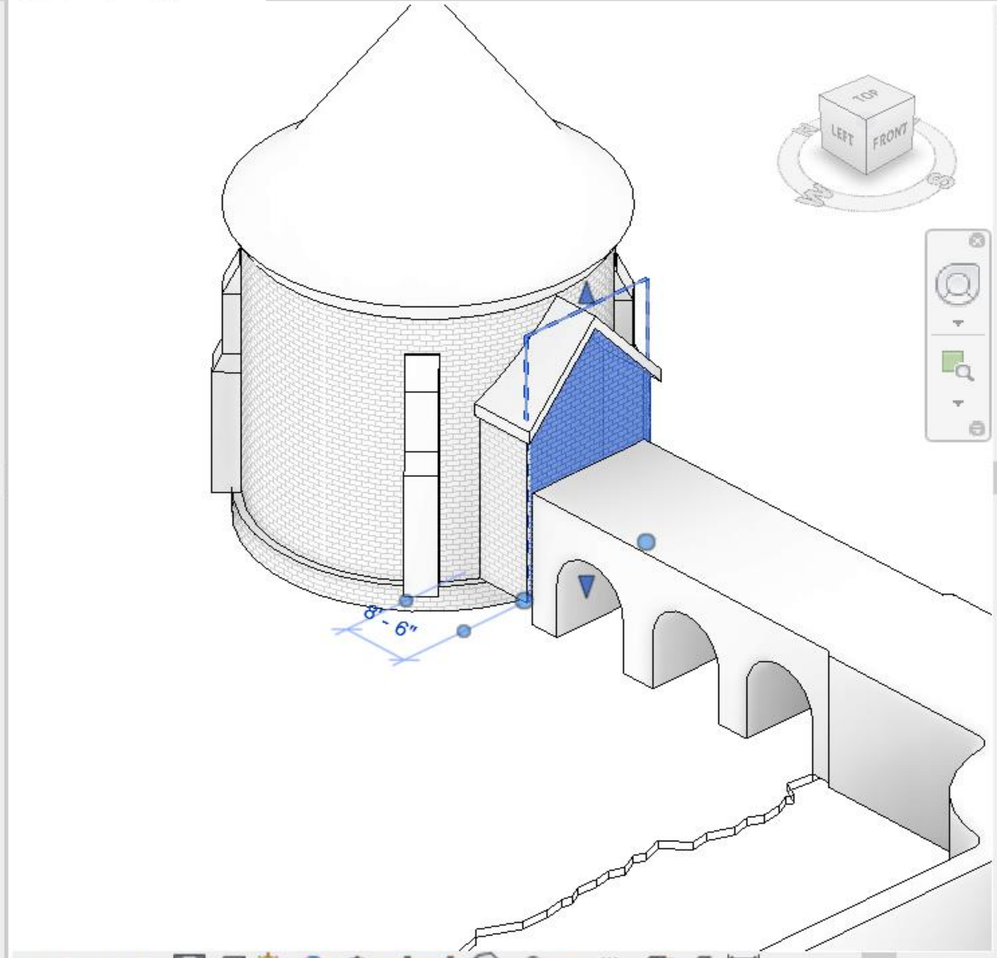
- Views (all)
  - Floor Plans
    - Level 7
    - Level 8
    - Reservoir
    - Site
    - Top of Gatehouse
    - Water Level
  - Ceiling Plans
    - Reservoir
    - Top of Gatehouse
  - 3D Views
    - {3D}

{3D} Copy 1



1/8" = 1'-0"

{3D} Copy 2

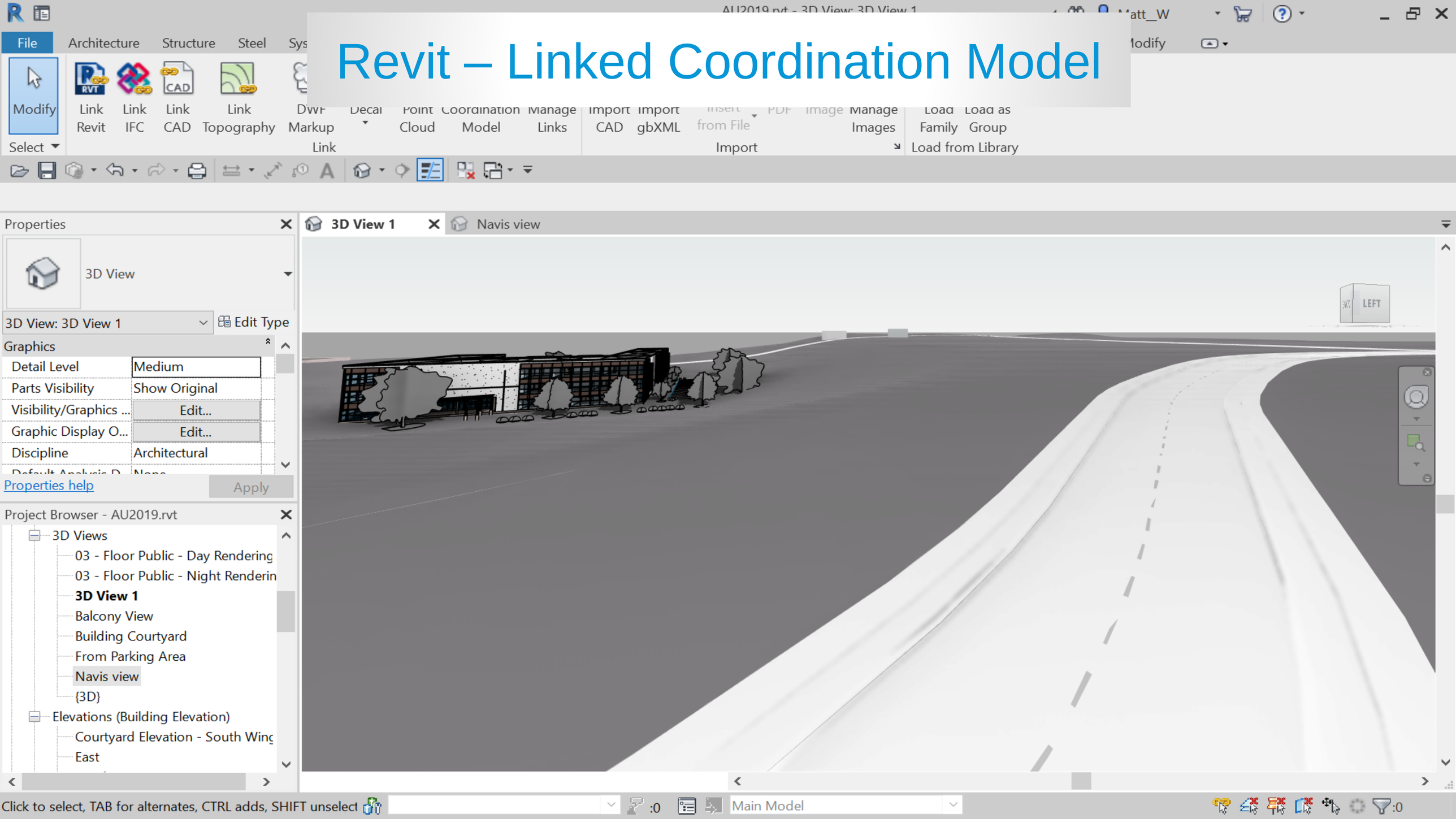


1/8" = 1'-0"

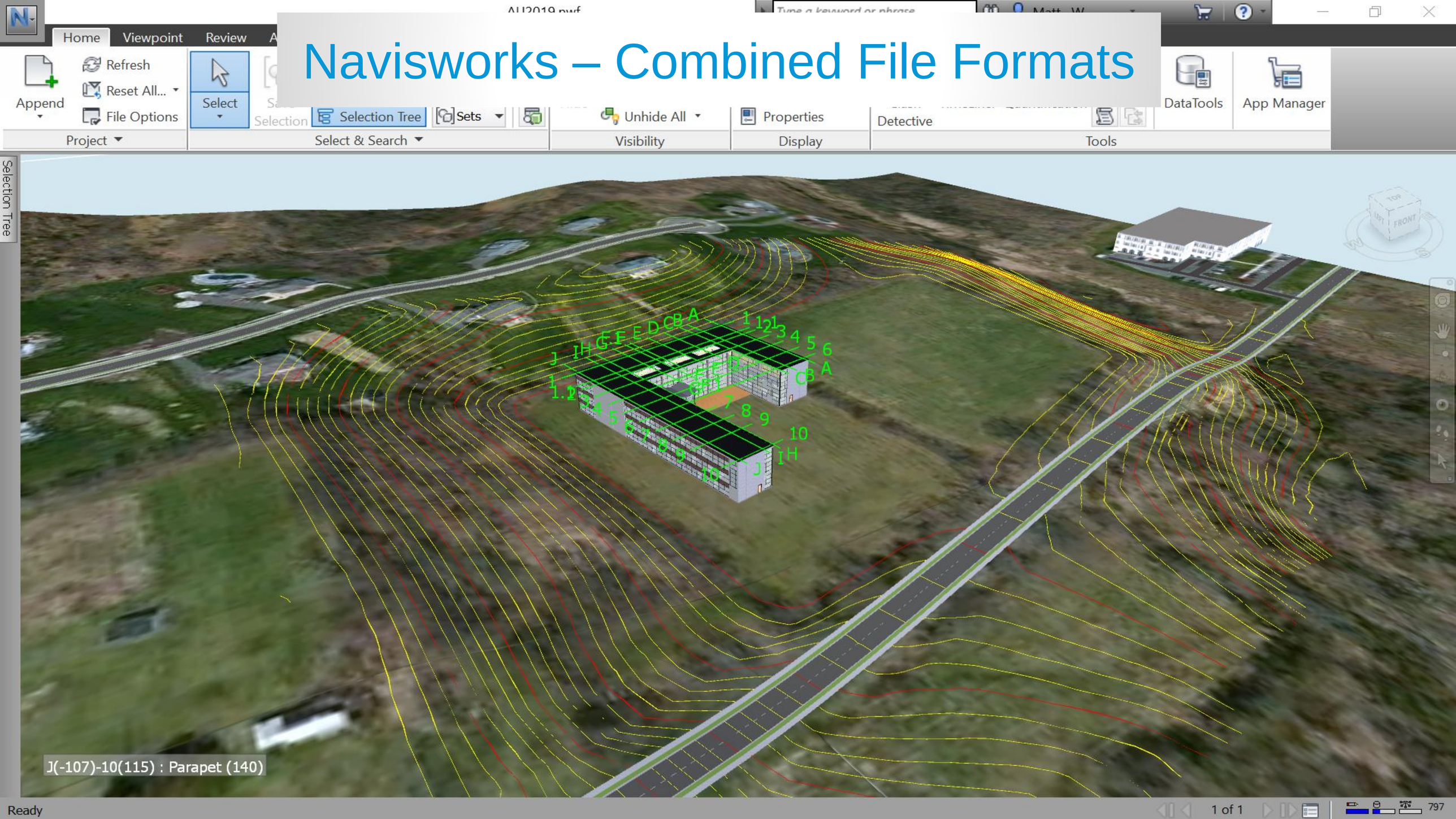
Click to select, TAB for alternates, CTRL adds, SHIFT unselect

:0 | Main Model | :1

Revit – Linked Coordination Model



Navisworks – Combined File Formats



BIM 360

LTE

Fox-Hill-Tower.fbx

Markup

Issue

Measure

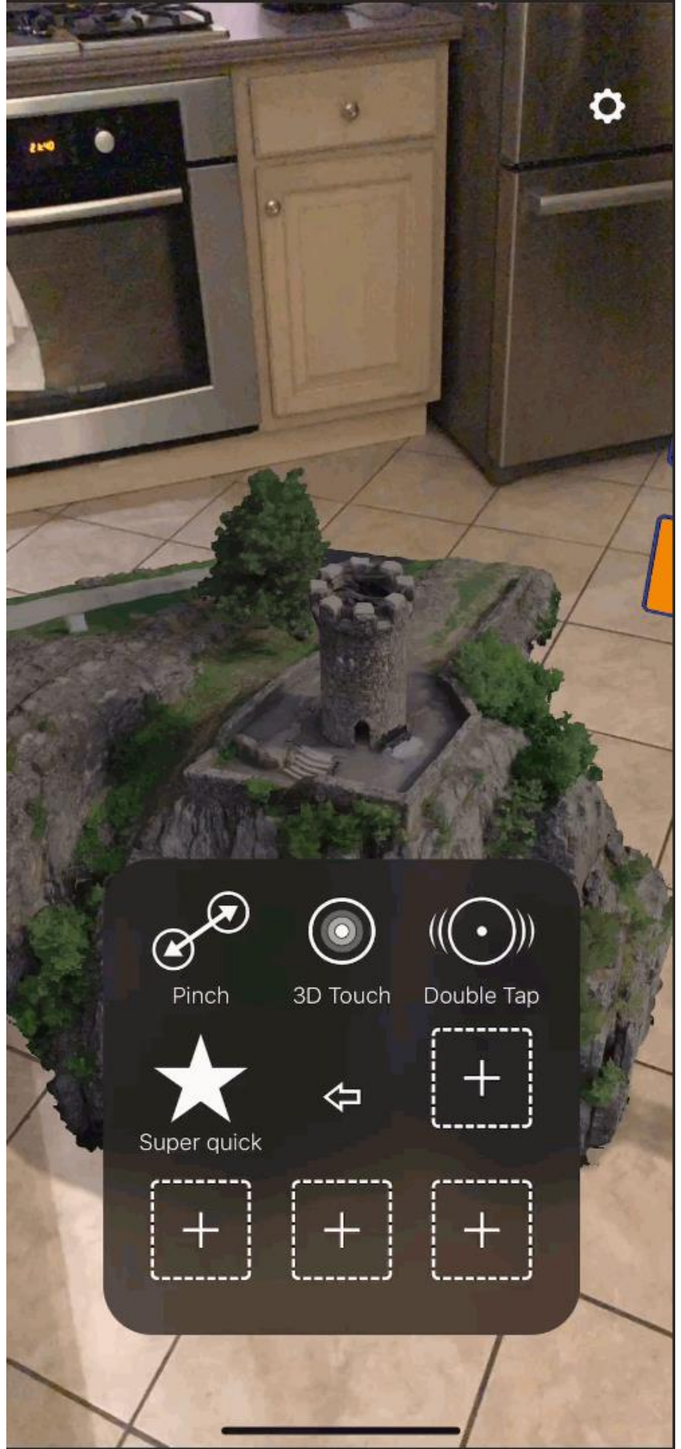
Geolocated Files – InfraWorks, Revit, Civil 3D

Complete Collaboration (and More) in 5 Simple Steps—Using the Architecture, Engineering & Construction Collection

https://www.autodesk.com/autodesk-university/class/Complete-Collaboration-and-More-5-Simple-Steps-Using-Architecture-Engineering-Construction

BONUS

Share the ReCap Photo model using augmented reality with Torch.app


Pinch
3D Touch
Double Tap
Super quick

AUTODESK®

Make anything™